

FASTING & PRAYER FOR MDOC

FASTING AND PRAYER: CAN IT HELP IN THE RESOLUTION OF MODERN  
DISEASES OF CULTURE?

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### Approval of the Dissertation

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### Abstract

Diseases of modern civilization represent the single largest driver of morbidity and mortality in the Western world. The predominant medical paradigm examines the health of the body nearly exclusively in terms of physiological and mental health, with a particular focus on physical and biochemical associations. This potential bias minimizes the role of the spiritual dimension of health. While there has been movement towards the investigation of Far Eastern practices, the extant literature from a religious perspective is wanting, despite 2000 years of theory and praxis. A literature review was performed examining the Orthodox Christian ascetic practices of fasting and *hesychastic* prayer, respecting the teleological and empirical evidence for their potential roles in benefiting human health. Additionally, a comparative analysis was conducted to provide further clinical validation from ostensibly similar practices of other traditions, e.g., Islamic fasting, secular intermittent fasting, yoga, meditation, and mindfulness-based stress reduction therapy. This evaluation demonstrated that a sufficient hypothetical framework exists for further exploration of these practices. Consequentially, a case series protocol was proposed for future investigation into the potential of Orthodox Christian asceticism in the resolution of the diseases of modern civilization.

*Keywords:* chronic disease, diseases of civilization, fasting, prayer, *hesychasm*, meditation, yoga, Orthodox Christianity

## FASTING & PRAYER FOR MDOC

To my mother, Erika, my late father, Henry, and my wife, Casey Lynn.  
More importantly, to my Lord and Savior, Jesus Christ.

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**CHAPTER 1: INTRODUCTION**

**Background**

In the beginning was the *Logos*. These words are some of the foundational statements regarding Christian theology. While commonly translated into English as “the Word,” this is a suboptimal definition that also, at minimum, encompasses explanation, reason, and truth. Science, at its root, is the search for truth, as further evidenced etymologically by both: (a) its tools (e.g., logic) and (b) its disciplines (e.g., biology and psychology). Although the West, since the Enlightenment, has attempted to establish a dialectical tension between religion and science, this has not always historically been the case (Marchal, 2017; VanderWeele, Balboni & Koh, 2017).

Moreover, in recent years, there has been an increased development of the literature into various religious and spiritual practices (e.g., meditation, yoga, and fasting) particularly from the Far Eastern perspective. Unfortunately, despite two thousand years of history, the research into the Orthodox Christian ascetic practices (e.g., *hesychastic* prayer and Orthodox fasting) is of less depth, which represents a mostly untapped area of inquiry. In support of this proposal, a more thorough examination will be undertaken concerning: (1) traditional religious practices in general; and (2) the resolution of modern diseases of civilization, to build a justified epistemic framework. Upon which, research can be developed for empirical validation.

**Western Paradigm of Disease Development.** Recent advances in a variety of scientific disciplines have led to the conclusion that all problems can be solved simply by applying more brain- and willpower. This belief comes as a result of Enlightenment-era

developments of the concepts of rank materialism and naturalism (Sorem, 2010; Hinshaw, 2013, pp. 16-18; Marchal, 2017; Berrios, 2018; Maung, 2019). These ideas were further developed from Freud onward, which viewed religion as pathological delusions, further eliminating the metaphysical from clinical investigation (Anderson et al., 2015; Berrios, 2018; Glannon, 2020).

As such, modern disease is often explained through an evolutionary model, specifically through the concept of “evolutionary mismatch” (Hidaka, 2012). According to this model, humans are the byproduct of genetic changes that were preferentially “chosen” in response to different environmental stimuli (e.g., food availability, in terms of quality and quantity), which, while advantageous at one point in time, is no longer optimal (Manus, 2018). In turn, this leads to the adaptive defense mechanisms becoming hyper-reactive and subsequently pathological (Gluckman et al., 2011; Boddy, Huang, & Aktipis, 2018).

The archetypal example of this is obesity, whereby chronic energetic scarcity throughout history has prompted the development of the neuroendocrine systems to promote energy storage, as adipose tissue, when energy supply is abundant (Hidaka, 2012). Specifically, it is argued that while preferences for dietary fat, sugar, and salt were beneficial during earlier “evolutionary” progression, humans have not had sufficient time or selective pressure to adapt to the current state of excessive availability (Nesse et al., 2012). Psychologically, this process is described through operant conditioning, whereby external stimuli act as “positive” and “negative” reinforcements, which fosters a pattern of reward-based eating (Brewer et al., 2018). Another closely related instance is

type 2 diabetes mellitus, which is explained as an adaptive mechanism to prevent pathogenic damage from an exceedingly high glycemic insult (Gluckman et al., 2011).

This “evolutionary mismatch” is also implicated in the development of cancer, as energetic overconsumption is involved in the release of endogenous compounds, e.g., hormones, growth factors, and adipokines, associated with the promotion and progression of various cancers (Ducasse et al., 2015). It has also been postulated that the historically high incidence of infectious diseases has led to immunological trade-offs (i.e., adaptive immune system cells, more specifically, T helper cells) have differential effects on infections versus cancer, with the downregulation of the cells necessary for combating one; which leads to an increased susceptibility to the other (Jacqueline et al., 2017; Boddy, Huang, & Aktipis, 2018).

**Modern Diseases of Civilization.** The Western lifestyle, characterized by obsessive overindulgence and associated psychosocial stress, is a powerful driver in modern chronic disease epidemics (Razzoli et al., 2017). Based upon the Centers for Disease Control and Prevention (CDC) 2016 data, 29.5% of the United States population is obese and 35.2% is overweight (Brewer et al., 2018). Moreover, a strong correlation was found between various psychological cues and maladaptive eating behaviors (Brewer et al., 2018).

Chronic disease represents the single largest cause of disability, death, and reductions in health and quality of life (Bauer et al., 2014). In 2010, 50.9% of US adults had at least one chronic health condition, with 25% having multiple chronic conditions (Ward & Schiller, 2013). Unfortunately, these numbers have remained consistent, as by 2018, approximately 133 million Americans were suffering from at least one chronic

disease (Raghupathi & Raghupathi, 2018). The presence of multimorbid conditions is also positively correlated with a proclivity towards substance abuse, thus indicating a potential contributor to maladaptive lifestyle behaviors (Wu, Zhu, & Ghitza, 2019). Moreover, the overwhelming majority (>90%) of patients hospitalized for opioid misuse suffer from multiple chronic conditions (Rajbhandari-Thapa et al., 2019).

Habitual overnutrition is well established in the development of systemic inflammation, insulin resistance, and subsequent metabolic disease, predominantly through the induction of chronic low-grade inflammatory molecular signaling (Caputo, Gilardi, & Desvergne, 2017; Harvie & Howell, 2017). In addition, excess adiposity, i.e., obesity and overweight, plays a role in the 2.8 million deaths per year, with more than 2 billion adults over the age of 20 falling into this category, worldwide (Lee et al., 2012). Whereas historically, life was characterized by a more intermittent food supply, the introduction of industrial food production has facilitated the progression of this epidemic (Fond et al., 2013; Mani, Javaheri, & Diwan, 2018).

While simple energy imbalance represents the more superficially causal factor, there are also genetic, environmental, and psychosocial factors that play a role in the development of body fat gain: (Lee et al., 2012). From a purely materialist perspective, neurochemical regulation, e.g., dopaminergic, serotonergic, opioid, and cannabinoid systems, plays a role in the dysregulation of reward processing, thereby contributing to overeating (Volkow, Wang, & Baler, 2011; Brewer et al., 2018). Additionally, there are issues of hypothalamic dysfunction in the metabolic satiety signaling pathways, e.g., leptin, insulin, and ghrelin, which further induce weight gain: (Egecioglu et al., 2011).

Genetically, polymorphisms in the DOPA decarboxylase (DDC) and the tryptophan hydroxylase 2 (TPH2) genes play roles in emotional processing and decision making, specifically through their effects on dopamine and serotonin regulation, respectively (Gutknecht et al., 2012; Oh, Park, & Kim, 2016; Gao, 2017). These dopamine deficiencies are also associated with: (1) increased reward-seeking and (2) a decreased desire towards physical activity, epitomized by lifestyle choices that result in the development and progression of obesity and chronic disease states (Kenny, 2011; Blum, Thanos & Gold, 2014; Kravitz, O’Neal, & Friend, 2016).

Interestingly, there is a significant overlap between the neuropeptide regulation concerning hedonic impulses that induce overeating and substance abuse, which has implications for how to properly treat overnutrition (Morganstern, Barson & Leibowitz, 2011; Ziauddeen et al., 2015). The role of these psychological inputs harkens back to the traditional Orthodox Christian conception of the passions, as illustrated by St. Maximos the Confessor, “The soul without wishing involves the body and is influenced by the body... partaking of its passions and sorrows through that faculty capable of receiving them” (Larchet, 2005, p. 21).

The lack of religiosity is another related risk factor, as attendance of religious service and increased sense of purpose in life is associated with reductions in cardiovascular events and all-cause mortality (Aldwin et al., 2014; VanderWeele, Balboni, & Koh, 2017; Wen et al., 2019). A recent retrospective study that analyzed 5449 individuals found that those who attended church had a significantly lower allostatic load, as well as a 55% reduction in all-cause mortality, as compared to the non-churchgoing group (Bruce et al., 2017). However, the authors noted that allostatic load

only accounted for a portion of the differences, thus indicating the potential for an effect independent of stress reduction explicitly (Bruce et al., 2017). In practice, this relationship, as applied to women, has been found to have beneficial effects at reducing rates of alcohol, tobacco and illicit substance use, depression, suicidality, as well as cancer, cardiovascular and all-cause mortality (Kleiman & Liu, 2014; Kobayashi et al., 2015; Li et al., 2016; Morton, Lee, & Martin, 2017; Park et al., 2017).

A primary mediator in cardiovascular incidents is likely the positive association observed between religiosity/spirituality (R/S) and reductions in hypertension (Bell, Bowie, & Thorpe, 2012; Charlemagne-Badal & Lee, 2016; Cozier et al., 2018; Meng et al., 2018). Regarding cancer specifically, R/S is associated with significant improvements to mental and physical health, as well as overall quality of life (Jim et al., 2015; Salsman et al., 2015; Sherman et al., 2015; Wen et al., 2019). Interestingly, evidence also exists in the literature for isolated, rural, island populations, in which deviation from traditional Orthodox Christian practices has resulted in increased cardiovascular disease risk (Kapelios et al., 2017).

Binge eating, characterized by periods of “uncontrollable” overeating, is often triggered by an escapist desire to avoid disturbing thoughts and feelings which is associated with a lack of fulfillment in the spiritual dimension (McIver, McGartland, & O’Halloran, 2009; Kristeller & Jordan, 2018). The literature has demonstrated the potential for mindfulness and intuitive eating interventions in improving the self-regulation of food intake (Warren, Smith, & Ashwell, 2017). A recent case study examined “whole-person integrative eating,” whereby a focus on “mindfulness” was one factor in addressing psycho-bio-socio-spiritual factors in the development of obesity

(Kesten & Scherwitz, 2015). Through these practices, there is a potential for regulation of the hypothalamic-pituitary-adrenal axis and neurotransmitter release, with downstream effects on weight management, cardiovascular, and other chronic diseases (Prasad, 2016; Laird et al., 2019).

Conversely, in specific populations, particularly individuals belonging to Baptist and other “fundamentalist” Christian denominations, there is a positive correlation between religiosity and overweight/obesity; however, this effect is attenuated by actual attendance of religious services, when compared to only at-home “religious media practice” (Cline & Ferraro, 2006; Reeves et al., 2012; Yeary, Sobal, & Wethington, 2017). Having established that, a problem with regular religious service attendance is the potential for greater consumption of high caloric “comfort foods” at communal gatherings, as another study found an association to higher rates of childhood obesity in families with familial attendance. Nevertheless, the same trial also found lower child BMI in the families that featured greater parental endorsement of religiosity; thus, the issue has more to do with extraneous factors beyond personal R/S (Limbers et al., 2015).

Modern Western society has resulted in a population that is over-stressed; overfed; undernourished; sedentary; sleep-deprived; socially-isolated; and sun-deficient; which in addition to physical disease, has resulted in mental health issues (Hidaka, 2012). Unfortunately, these issues are not mutually exclusive, as many cases present with high rates of comorbidity, e.g., metabolic syndrome and depression (Rajan & Menon, 2017; Sartorius, 2018). Chronic diseases and their associated somatic pains are also associated with higher rates of psychological distress and suicidal ideation (Fässberg et al., 2016; Kim, 2016; Zhu et al., 2018; Santos et al., 2020). Moreover, the relationship between

physical and psychological disease is bidirectional insomuch as poor health negatively affects mental health, and poor mental health contributes to deteriorating bodily health (Feller et al., 2013; Yu et al., 2015; De Hert, Detraux, & Vancampfort, 2018).

Just as chronic disease, e.g., obesity or cancer diagnoses, can lead to the development of anxiety and depression, psychological stress from existential crises can result in disorders of overindulgence (Garcia et al., 2018; Rodino, Gignac, & Sanders, 2018). Thus, through feelings of hopelessness, individuals can progress towards chronic disease, addictions, obesity, and diabetes (Mooreville et al., 2014; Chao, Wadden, & Berkowitz, 2019; van Os et al., 2019). In particular, anxiety, depression, stress, and worry are related to the development of various risk factors, as well as subsequent progression to cardiometabolic disease; however, as noted before, previous disease states can also result in the induction of further anxiety and depression (Tully, Cosh & Baune, 2013; Liu et al., 2019; Murphy et al., 2020). As “mental” illness accounts for approximately 33% of adult health disability and 20% of disease burden globally, there needs to be changes to the methods and delivery of care in the “mental” health domain (Lake & Turner, 2017; Campion et al., 2020).

Interestingly, despite recent attempts to demonize religion as a causative factor in decreased mental health, the literature does not support this hypothesis. Much research has found religiosity to be positively correlated with reductions in anxiety, depression, substance abuse, suicidality, and stress resistance (Lee & Newburg, 2005; Koenig, 2009; Giorgadze, Shengelia, Durglishvili, 2017; Dein, 2018; Lerman et al., 2018). Moreover, higher degrees of spirituality are associated with greater mental, emotional and physical health resilience, principally through the establishment of a feeling of meaning and



purpose, i.e., *telos* (Womble, Labbé, & Cochran, 2013; Anand, Jones, & Gill, 2015; Estrada et al., 2019). Recent research with schizophrenics has found that increased positive religiosity is associated with improved social functioning and quality of life, as well as decreased negative symptomology and psychopathology, through the development of increased hope and meaning (Mohr et al., 2011; Grover, Davuluri, & Chakrabarti, 2014; Triveni, Glover, & Chakrabarti, 2017). Additionally, a cross-sectional cohort study following individuals with advanced-stage chronic illnesses, specifically cancer, chronic obstructive pulmonary disorder, and congestive heart failure, found a statistically significant ( $p < 0.001$ ) correlation between the purpose and life meaning domains of spirituality and decreased symptoms of both anxiety and depression (Johnson et al., 2011).

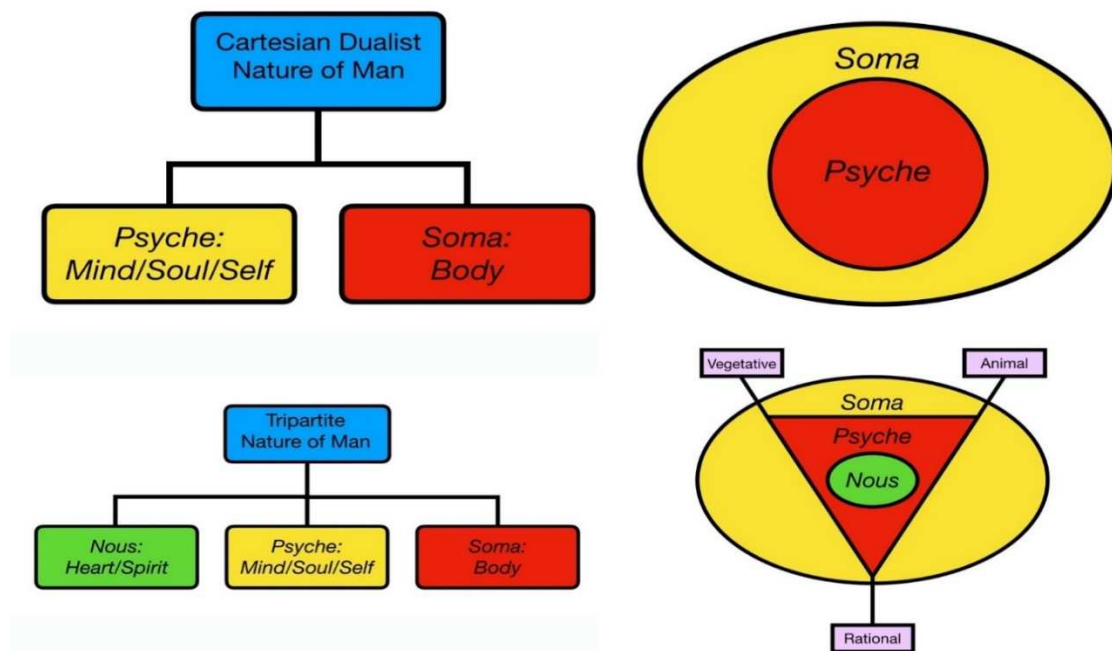
Concerning increased longevity, decreased mortality, and adherence to healthy lifestyle behaviors, religiousness was found to be of tremendous benefit. In particular, this advantage is related to the development of a greater sense of coherence, i.e., the confluence of factors such that life is comprehensible, manageable, and meaningful. Moreover, this finding was found in research specifically into both monastic and laymen and women in the Orthodox Christian tradition (Anyfantakis et al., 2015; Merakou et al., 2017; Merakou, Xefteri, & Barbouni, 2017). This sense of coherence is associated with greater cardiovascular outcomes and reductions in all-cause mortality, presumably through improved optimism and sense of control (Lionis et al., 2010).

An additional area where Orthodox Christian religiosity has demonstrated improved subjective mental health benefit is in the quality of life of cancer patients undergoing chemotherapy (Assimakopoulos et al., 2009). The authors found the practice

and worldview to be linked to an improvement in optimism and positive outlook (Assimakopoulos et al., 2009). Clinical data on R/S has also confirmed a relationship between these metrics and significantly reduced rates of depression, as well as improved depression remission time (Koenig, 2008; Assimakopoulos et al., 2009; Bonelli et al., 2012; Koenig et al., 2015; Lucette et al., 2016). In practice, higher degrees of religiosity, particularly the practice of prayer is correlated with reductions in multiple behavioral risk factors (e.g., smoking, alcohol overconsumption and overweight) implicated in the development of chronic disease (Linardakis et al., 2015, VanderWeele, Balboni, & Koh, 2017).

**Orthodox Christian Epistemology.** While modern, Western conceptions of anthropology generally fall into one of two categories: (1) a Cartesian substance dualist division of “mind” and body, which are ontologically distinct; or (2) a monistic purely body (specifically the brain) or a property dualist position, with the “mind” as an abstract epiphenomenon, subsequent to biologically determined chemical and electrochemical reactions (Larchet, 2005, pp. 16-17; Diller & Lattal, 2008; Sorem, 2010; Jakovljević, 2017; Robertson, 2017; Berrios, 2018; Moreira-Almeida, Araujo, & Cloninger, 2018; Maung, 2019; Glannon, 2020). Taken to its logical conclusion, the materialist, evolutionary framework invariably collapses to one of the latter (Larchet, 2005, pp. 16-17; Diller & Lattal, 2008; Sorem, 2010; Jakovljević, 2017; Robertson, 2017; Berrios, 2018; Moreira-Almeida, Araujo, & Cloninger, 2018; Maung, 2019; Glannon, 2020). Conversely, as illustrated in Figure 1, from the Orthodox Christian perspective, man is a composite of body (*sōma*), soul (*psychē*) and spirit (*nous*) (Larchet, 2005, pp. 26-28; Smith, 2012, p. 69; Ilievski, 2015; Larchet, 2017, pp. 13-17). The *psychē* is subdivided

into: (a) vegetative (e.g., nutrition, growth, and reproduction), (b) animal (e.g., aggression and emotion), and (c) rational (e.g., reason, abstraction, and self-determination) levels, with the *nous* representing the higher aspects of the soul (e.g., intuition and contemplation), more commonly associated with consciousness (Larchet, 2005, pp. 26-28; Smith, 2012, p. 69; Ilievski, 2015; Larchet, 2017, pp. 13-17). This divide arose through the West's adoption of scholasticism, which folded the *nous* into intellectual knowledge, generating a philosophical gulf between science and religion that is only beginning to be breached today (Vujisic, 2009).



1. Figure Western vs. Orthodox Christian model of mans' nature.

Although these delineations may seem pedantic, their implications on etiology and appropriate treatment of physical and mental health are vast. In the West, the world is generally viewed as the product of constant flux and chaos, of which disease and death is merely a “natural” component. Conversely, from the Orthodox perspective, the world

is by nature “good,” but has become subject to corruption and decay through man’s own volition, which resulted in the “darkening of the *nous*” (Larchet, 2002, pp. 32-34; Smith, 2012, pp. 144-145). Specifically, St. Maximos the Confessor states that man “brought the sentence of death on all nature, since through man it impels all created things towards death” (Harakas, 1990, p. 37). Though the Western paradigm can often accurately describe physical symptomology, it misses the mark on the root causes (Hamalis, 2013). The reason as such is due to a faulty anthropology (Hamalis, 2013).

While not denying the ontological reality of physiological and psychological disorders, this perspective offers explanatory power to the existence of “mental health” disorders, e.g., anxiety and depression, which exhibit suboptimal outcomes from pharmaceutical interventions (Larchet, 2005, p. 13; Fond et al., 2013; Johnson, 2018). Too often, there is an impulse to overprescribe medication, at the expense of addressing the root cause (Larchet, 2005, p. 3; van Os et al., 2019). In such cases, a more accurate diagnosis might be noogenic neuroses, i.e., existential lack of meaning and purpose, or *telos* (Larchet, 2005, pp. 94-95; Koenig, 2009; Ilievski, 2015; Negru-Subtirica et al., 2017; Johnson, 2018; Larrivee & Echarte, 2018).

This concept of the noogenic neurosis is further evidenced by two, often comorbid, modern epidemics: (1) narcotic (particularly opioid) abuse; and (2) social media addiction (Steers, 2016; Fumero et al., 2018; Larchet, 2019; pp. 11-12). Both are commonly used as existential coping mechanisms to escape from external reality, the latter of which has been described as the “drug of the future” (Steers, 2016; Fumero et al., 2018; Larchet, 2019; pp. 11-12). Moreover, the literature suggests that there is a strong inverse association and likely causal relationship between R/S and substance abuse

(DeWall et al., 2014; Park et al., 2017; Francis et al., 2019). A profound lack of *telos* is often at the root of these developments, whereby an individual feels isolated, alienated from the soul, and thus seeks to satisfy it somehow (Ho & Ho, 2007; Błachnio et al., 2016; Lee et al., 2016; Larchet, 2017, pp. 38-39; Johnson et al., 2018). Unfortunately, rather than fulfillment, this often leads to their enslavement, such that the vice provides the new impetus that drives the course of the individual's life. These modern addictions, while providing novel stimuli, yet at root are properly articulated through the traditional passions, or *pathoi*, outlined by the Church Fathers: e.g., *philautia* (i.e., self-love or narcissism), pride, vanity, *acedia*, gluttony, sexual passions, avarice and anger (Larchet, 2017, pp. 34-35). Fortunately, this spiritual medicine framework, handed down through the Church Fathers, provides the underpinning for testing this hypothesis through observation and experiment (Vlachos, 2010, pp. 55-56). Although, not thoroughly examined to date, there have been some investigations in some small-scale settings (Chliaoutakis et al., 2002; Delimaris, 2012; Koufakis et al., 2017; 2018).

Despite the potential for confusion, the Orthodox Christian worldview does not see dialectical tension between conventional, naturalistic modalities and the aspects of the metaphysical; but instead, views them working holistically in concert. As illustrated by St. Basil the Great, "To place the hope of one's health in the hands of the doctor is the act of an irrational animal. This, nevertheless, is what we observe in the case of certain unhappy persons who do not hesitate to call their doctors their saviors. Yet, to reject entirely the benefits derived from this [medical] art is the sign of a pettish nature" (Schopp, 2012, p. 333). Moreover, there is a similar view of the body, i.e. despite the tripartite understanding of man, his nature is still unified; thus, the goal in obtaining

health is to address all aspects (Nicolaidis et al., 2016). As further clarified by St. Irenaeus, “For that flesh which has been molded is not a perfect man in itself, but the body of a man, and a part of a man. Neither is the soul itself, considered apart by itself, the man; but it is the soul of a man, and a part of the man” (Larchet, 2005, pp. 17-18).

**Orthodox Christian Ascetic Practices.** The primary purpose of Orthodox Christian ascetic practices is the development of repentance. In the West, this concept carries connotations of acceptance (and subsequent feelings) of guiltiness, which is often characterized as a negative religious coping mechanism (Dein, 2018). However, this is a misunderstanding of its etymological root (i.e., *metanoia*), which literally translates to “change of mind” (Ilievski, 2015). Moreover, unlike the standard call of a health practitioner for the patient to make a “lifestyle change,” this is not merely a logical undertaking to believe something else, but rather a change of the *nous*, the higher intellect. Thus, in the Orthodox worldview, repentance is understood to mean a fundamental shift in the person’s body, mind, and spirit (Damascene, 2012, p. 285-287).

Unlike secular methods of fasting, the primary goal is not explicitly the removal of the food, but rather the emptying of the person, and subsequent fulfillment with the Spirit, in the process of deification, or *theosis* (Meyendorff, 1998 p. 122; Lazarou & Matalas, 2010; Smith, 2012, pp. 194-195; Hamalis, 2013; Ilievski, 2015). As stated by the Prophet Joel, “Now says the Lord your God, turn to Me with all your heart, with fasting and wailing and mourning” (Joel 2:12, Orthodox Study Bible). This is further articulated by the Prophet Daniel, “Then I set my face toward the Lord God to seek Him in prayer and supplication, with fasting...” (Daniel 9:3).

However, fasting is also promoted to specifically address the passion of gluttony, i.e., that by not indulging in the passion, it removes the gratification for overindulgence, thereby driving it away (Bradford, 2011). Synthesizing these two concepts, through fasting, the goal is to combat addictive behaviors to food, by focusing on improving the whole person through deification, rather than deifying the stomach (Schopp, 2012, pp. 275-276; Mazokopakis & Samonis, 2018). The undertaking of fasting, along with vigilant prayer, helps engender a state of discipline for the redirection of the passions towards better choices (Palamas, 1999, p. 22).

Superficially, the practices may seem unnecessarily austere, but from the Orthodox perspective, the goal is the voluntary acceptance of suffering (Bradford, 2011). Moreover, as stated by St. Symeon the New Theologian, “To those who have no knowledge of this practice, it appears extremely harsh and arduous...” (Smith, 2012, p. 63); however, as articulated by St. John Chrysostom, “sufferings are a perfecting... that to suffer affliction is not the portion of those who are utterly forsaken” (Hatfield, 2006). As suffering, illness, and death are inevitable components of the “natural” world, one is faced with the choice of following: (1) the way of the world, or (2) through *metanoia* (Harakas, 1990, p. 50). Thus, in contrast to the attitudes unfortunately all too common in the West, to the Orthodox Christian, the periods of fasting, and concurrent increased mental and spiritual vigilance, are found to engender a feeling of “joyful sorrow” (Hatfield, 2006).

***Orthodox Christian Fasting.*** In terms of dietary practices, Orthodox Christian fasting is characterized by a cyclical pattern of low-fat, semi-vegan Mediterranean-style diets for approximately 180-200 days of the year, throughout the ecclesiastical year,

during fasting periods (Quinton & Ciccazzo, 2007; Papadaki et al., 2008; Lazarou & Matalas, 2010; Delimaris, 2012). Specific fasting periods include most Wednesdays and Fridays, as well as the 40-day, 48-day and 15-day fasts for Christmas/Nativity, Easter/*Pascha*, and the Assumption/Dormition, respectively, with an additional fast of varying length known as the Apostle’s fast (Sarri et al., 2004; Quinton & Ciccazzo, 2007; Lazarou & Matalas, 2010; Smith, 2012, p. 34). While meats, eggs, and dairy are always excluded, the fasts are of varying degrees of strictness, regarding oil, wine, and fish; but, shellfish, e.g., crabs, lobsters, octopus, shrimp, oysters, and squid, are allowed throughout, as illustrated in Table 1 (Sarri et al., 2004; Quinton & Ciccazzo, 2007; Lazarou & Matalas, 2010; Smith, 2012, p. 34).

Table 1.  
*General Guidelines for Orthodox Fasting*

Allowed Fast Day Foods	Excluded Fast Day Foods (strictness varies)
1. Vegetables and fruits	1. Meats, e.g., beef, pork, poultry, gelatin
2. Nuts and seeds	2. Dairy, e.g., milk, butter, cheese, yogurt, eggs
3. Shellfish, e.g., crustaceans, mollusks	3. Fish, e.g., salmon, tuna, cod
4. Grains and legumes	4. Oil, specifically olive oil
5. Drinks, e.g., water, tea, coffee, juices	5. Alcohol, specifically wine
6. Honey	

On “strict fast” days, meals may include all fibrous and starchy vegetables, fruits, nuts, seeds, grains, legumes, honey, shellfish, and non-alcoholic beverages; whereas on “oil and wine” days, olive oil and wine can be incorporated in moderation (Vujisic, 2009). There are also days specified as “oil, wine, and fish,” which includes all of the previous foods, but also allows for the addition of fish with backbones. If not otherwise indicated, then all foods are allowed. However, while not explicitly articulated by the Church Fathers, as it was not yet a concern with which they had to contend, modern



highly refined “foods” would be recommended to be avoided, as they would not have been provided for by God. Quantities are to be controlled, but there are no precise caloric intake requirements (Vujisic, 2009).

As expressed by St. John Chrysostom, “Fasting is a medicine; but a medicine though it be extremely profitable, becomes frequently useless owing to the lack of skill of the one who employs it. For it is necessary to know, moreover, the time when it should be applied, and the requisite quantity; and the temperament of body that admits it; and the nature of the country, and the season of the year; and the corresponding diet; as well as various other particulars; any of which, if one overlooks, he will mar all the rest that have been named” (Vujisic, 2009). Thus, there is a large degree of individualization for the application of the fasting protocols to suit the needs of the individual in question.

Given the unique anatomical, physiological, genetic, and microbiotic composition of every person, along with their current psychological and pathological status, as well as their particular physical demands, it is inappropriate to make sweeping generalizations regarding the specific nutritional intake of every person (Trepanowski & Bloomer, 2010). Within the framework of the Orthodox Christian fasting periods, the dietary protocol advises for the “moderate” intake of the foods mentioned above, with the definition of “moderate” varying on a case by case basis. An individual working at a desk is going to have significantly different needs than one who is working manual labor. Similarly, someone currently battling an illness will have different demands than one who is well. Food availability, concerning both geographic location and the season, is also a factor, which in turn provides considerations for both: (1) the cultural and ancestral diet of a person; and (2) a focus on locally sourced foods.

While it is possible to question the degree to which this can be properly be described as a “fast,” for those who are able, but more importantly to whom it would be profitable, the fasts do resemble more familiar secular intermittent fasting protocols, i.e., single small meals with extended periods of no consumption of food or water. At the beginning of Lent, there is a 3-day prescribed fast, that again, is recommended to be done with appropriate counseling. Having established that, the ability to customize the dietary intake provides latitude in making the best possible recommendations for the individual. Moreover, as has previously been described from the Orthodox Christian framework, the food is not an end in and of itself, but rather as a complement to and preparation for prayer (Di Leo, 2007).

***Hesychasm.*** As St. James extols us in the Epistle of James, “Is anyone among you suffering? Let him pray...” (James 5:13). *Hesychia* specifically refers to both the external stillness of the body and the internal stillness of the nous, whereby one engages in the ascetic practice of *hesychasm* for the development of *nepsis*, or “watchfulness,” through controlled breathing, physical actions, and repetitions of the *Jesus Prayer* (Di Leo, 2007; Vujisic, 2009; Ilievski, 2015). As expressed by Evagrius Ponticus, “when you pray, do not shape within yourself any image... do not let your intellect be stamped with the impress of any form... Prayer is putting away of thoughts” and St. Diadochus of Photike, “the intellect requires of imperatively some task that will satisfy its need for activity... Let the intellect continually concentrate on these words within its inner shrine with such intensity that it is not turned aside to any mental images” (Ware, 2014, pp. 8-9). Thus, through disciplined repetition, the acquisition of *hesychia* helps to bring the fragmented into unity through the silencing of the hyper-stimulated mind.

Specifically, *hesychasm* employs the *Jesus Prayer*, which refers to the recitation of the phrase: “Lord Jesus Christ, Son of God, have mercy on me, a sinner;” wherein the first part, “Lord Jesus Christ, Son of God,” is synchronized with the inhale and the latter portion, “have mercy on me, a sinner,” with the exhale (Bakić-Hayden, 2008; Johnson, 2009; Vujisic, 2009; Ware, 2014, pp. 31-32). While there are various methodologies for this, as a general rule, breathing should be slowed and controlled, but the words are to be delivered without exaggerated emphasis, instead flowing forth “like a small murmuring stream” (Ware, 2014, pp. 25-26).

Bodily, hands are to be open and outstretched, maintaining a crouched seated position or standing, accompanied by prostrations, i.e., bowing down, lying stretched out on the ground (Vujisic, 2009; Ware, 2014, 26-27). Regarding these movements, Theoliptos, Metropolitan of Philadelphia maintained the importance to “... not neglect prostration. It provides an image of man’s fall into sin and expresses the confession of sinfulness. Getting up, on the other hand, signifies repentance and the promise to lead a life of virtue” (St. Nikodimos et al., 1995, pp. 185-186). Therefore, these actions provide a physical representation and acknowledgment of the ways that one has missed the mark (*hamartia*), paired with the subsequent necessity to make better choices (*metanoia*). Additionally, a prayer rope, also known as a *chotki*, is often utilized for the improvement of concentration (St. Nikodimos et al., 1995, p. 185; Johnson, 2009; Ware, 2014, pp. 30-31). Rather than being considered some kind of talisman, it is designed as a further means of centering the mind towards a single focus, giving the hands something to do to improve *hesychia* (St. Nikodimos et al., 1995, p. 185; Johnson, 2009; Ware, 2014, pp. 30-31).

The psychosomatic techniques of hesychasm, e.g., outstretched hands, specific bodily stances and verbal utterances, are not ends in and of themselves, or even the critical focus, but rather the purpose is the establishment of faith and the aforementioned repentance (*metanoia*) (Meyendorff, 1998 p. 59; Palamas, 1999, p. 12; Damascene, 2012, p. 377). This practice, as articulated by St. Nikitas Stithatos, “consists not in what is externally perceived... but in our inner concentration on the intellect’s activity...” (Smith, 2012, pp. 100-101). However, St. Mark the Ascetic stated, “The intellect cannot be still unless the body is still also; and the wall between them cannot be demolished without stillness and prayer” (Smith, 2012, p. 165).

The Church Fathers categorized the psychological temptation processes, i.e., *logismoi*, into a series of successive stages: (a) suggestion or provocation; (b) inner dialogue, subdivided into coupling, passion, and wrestling; and subsequently, (c) captivity, consent or assent, and finally actualization (Vujisic, 2009; Smith, 2012, pp. 153-155). As further developed by St. John of Damascus, “It does not lie within our power to decide whether or not impassioned thoughts are going to arise and disturb us. But to dwell on them or not to dwell on them, to excite the passions or not to excite them, does lie within our power... If we can confront the first of these things, the provocation, in a dispassionate way, or firmly rebut it out the outset, we thereby cut off at once everything that comes after.” Thus, the synergistic action of *nepsis* and *ascesis* is described as a method of combatting the *logismoi*, from the first mental suggestion, through redirection of these thoughts, before the passions, i.e., *pathos*, develop into a pathological state.

### **Rationale**

The rationale of this paper is to further elucidate and articulate these practices for potential therapeutic benefits in the mitigation of the diseases of modern civilization. While in the Orthodox Christian worldview, it is impossible to disentangle metaphysics, epistemology, and ethics, even if one were to reject the metaphysical presuppositions of the faith, it is still possible to examine the empirical validity of the practices. Thus, where there is extant literature, the psychosomatic methods of *hesychastic* prayer, i.e., breathing patterns and bodily positions, will be explored for their therapeutic efficacy; however, this will be supplemented by explorations of exoterically similar, yet fundamentally distinct practices, e.g., yoga and meditation (Johnson, 2009; Rose, 2004, p. 38; Damascene, 2010; p. 80). Likewise, the Orthodox Christian fasting model, which represents a semi-vegan, generally calorically restricted diet, for approximately half of the year, will be explored both directly and through comparison to similar fasting methodologies.

### **Research Significance**

Whereas historically, infectious disease and violence have represented some of the biggest drivers of suffering and mortality; today, chronic disease and “mental” health issues are some of the greatest morbidities, particularly in the West (Johnson, 2009). Thus, the primary outcome of this review is determining the therapeutic potential of Orthodox ascetic practices in reducing disease burden and improving lifespan. A secondary outcome is whether these can improve “mental” health and quality of life, mainly through the establishment of a *telos*, or purpose. While there is often an overly legalistic understanding in the West, the Orthodox view their beliefs more in the medical

framework, *i.e.*, the cleansing of the *nous*, which has implications for the restoration of “mental health” (Wieczynski, 1969; Di Leo, 2007; Johnson, 2009). Considering these factors, the purpose of this paper is to explore whether the implementation of Orthodox Christian ascetic practices can provide benefits in the reduction of chronic disease burden.

### **Research Goal**

The goal of this dissertation research is to assess the potential role of Eastern Orthodox Christian ascetic practices, e.g., fasting and hesychastic prayer, in the healing of conditions suboptimally addressed by the current Western medical paradigm.

### **Research Questions**

- 1) Does fasting improve cardiometabolic and “mental health?”
- 2) Do psychosomatic prayer and meditation improve cardiometabolic and “mental health?”
- 3) Is there a missing domain in the understanding of “health?”
- 4) Do secular and non-Orthodox Christian worldviews have sufficient logical coherence epistemically to support reliability in their outcomes?
- 5) Does Eastern Orthodox Christianity provide a framework with better explanatory power vis-à-vis the resolution of diseases of modern civilization?

### **Research Objectives**

- 1) To assess the epidemiology and current standard of treatment for chronic disease and “mental health” from a Western medical perspective.
- 2) To assess the epistemic and teleological foundations of Eastern Orthodox Christian ascetic practices and examine the evidence for their empirical efficacy.

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- 3) To assess the comparative empirical efficacy of ostensibly similar practices from other traditions, to fill in the epistemic gaps of the extant clinical literature.
- 4) To determine the therapeutic potential of implementing Eastern Orthodox Christian ascetic practices in the mitigation of the aforementioned epidemics.

## CHAPTER 2: REVIEW OF THE LITERATURE

### **Orthodox Christian Fasting.**

Chronic overnutrition is widely accepted as a potent driver of the diseases of modernity. Similarly, combatting the passion of gluttony (*gastrimargia*, i.e., gut-madness) is a primary focus of Orthodox ascetic practices (Larchet, 2017, pp. 58-62). However, the *hamartia* is not exclusively in the overindulgence, but in the concurrent pathological attachment to sensuous desires, thus fasting is utilized for the development of temperance (*egkrateia*, i.e., self-control) (Larchet, 2017, pp. 58-62). As summarized by St. Maximos the Confessor, “If the intellect inclines to God, it treats the body as its servant, and provides it with no more than it needs to sustain life. But if it inclines to the flesh, it becomes the servant of the passions and is always thinking about how to fulfill its desires” (Smith, 2012, p. 143).

It is interesting that despite a several thousand-year-old, well established traditional understanding of, and etiology for, the concept of overindulgence in food, it is now regarded as a “novel” disorder in the form of hyperphagia and “food addiction” (Novelle & Diéguez, 2018; Rodríguez-Ortega & Cubero, 2018). The Wisdom of Sirach, states, “Do not be gluttonous for every dainty food, and do not give yourself over to food. For overeating will bring sickness... many have died because of gluttony, but the careful man will prolong his life.” (Wisdom of Sirach 37:29-31). This is another example of a consequence of adopting a purely materialistic framework. In focusing exclusively on the physiological and psychological dimensions, the existence of a disease is reduced to either an evolutionary epiphenomenon or outright denied which leads to suboptimal solutions (Larchet, 2005, p. 5; Glannon, 2020).



While Orthodox Christian fasting has existed for more than two-thousand-years, clinical evidence into its empirical efficacy is obviously more modern, with investigations into both monastic and lay communities (Lazarou & Matalas, 2010; Karras et al., 2017; 2019). However, the literature has found the Orthodox fasting methodology to improve a variety of physiological and psychological health biomarkers (Koufakis, 2018; Makedou et al., 2018).

Specifically, some benefits include improvements in lifestyle choices, blood lipid profile, and reductions in body mass (Sarri et al., 2003; Delimaris, 2012). In this longitudinal study, 120 generally healthy Cretan Orthodox Christian adults were observed for one year, separated into voluntarily selected fasting and non-fasting arms (Sarri et al., 2003). Significant improvements were demonstrated in the cardiometabolic biomarkers of the fasting group, both within and between groups, including: (a) body mass index (-1.5%,  $p < 0.001$ ); (b) total cholesterol (-12.5%,  $p < 0.001$ ); and (c) LDL cholesterol (-15.9%,  $p < 0.001$ ); when compared to the non-fasting arm (Sarri et al., 2003). Moreover, the dietary journal indicated that there were significant reductions in total energy intake (-10% versus 7%,  $p < 0.001$ ) and increases in fiber intake (43.5% versus 3.3%,  $p < 0.001$ ), in the fasting versus non-fasting groups, respectively (Sarri et al., 2003).

A prospective, cross-sectional study examined the dietary intake and cardiometabolic biomarker status of 70 Orthodox Christian Athonian adult, male monks on two days: (1) a “restrictive” day (RD), i.e., a weekday during Great Lent; and (2) a “non-restrictive” day (NRD), i.e., a weekend day during the Nativity, which is more relaxed (Karras et al., 2017). The authors found: (a) significant reductions to caloric

intake ( $p < 0.001$ ) on the RD ( $1265 \pm 84.5$  kcal) versus the NRD ( $1660 \pm 81.0$  kcal); (b) significantly lower dietary fat intake ( $p < 0.001$ ) on the NRD ( $21.4 \pm 0.6$  g) versus ( $30.0 \pm 0.1$  g); and (c) inadequate dietary intakes, on both RD and NRD days, of vitamin D ( $20.0 \pm 0.0\%$  DRI and  $19.8 \pm 0.0\%$  DRI), calcium ( $57.9 \pm 0.2\%$  DRI and  $66.5 \pm 0.2\%$  DRI), and magnesium ( $39.5 \pm 0.7\%$  DRI and  $36.26 \pm 0.9\%$  DRI), respectively (Karras et al., 2017). However, it is worth noting that the monks on Mt. Athos follow an even more strict version of Orthodox fasting year-round, i.e., pescatarian four days a week and semi-vegan on Monday, Wednesday, and Friday, which helps explain the lowered fat intake on the NRD and the overall micronutrient intake deficiencies.

In another prospective, cross-sectional study by the same research group, 100 Orthodox Christian Athonian monks and laypeople were observed on a RD weekday during Great Lent and a NRD weekend during the Nativity, which discovered the Athonian monks to exhibit significantly lower: (a) dietary fat intake on both the RD ( $30.07 \pm 0.18$ g versus  $54.94 \pm 26.92$  g,  $p < 0.001$ ) and NRD ( $21.47 \pm 1.96$  g versus  $104.59 \pm 9.27$ ,  $p < 0.001$ ); (b) serum triglycerides ( $73.82 \pm 31.68$  mg/dL versus  $113.22 \pm 79.09$  mg/dL,  $p < 0.001$ ); (c) serum insulin: ( $4.61 \pm 3.16$   $\mu$ g/mL versus  $11.64 \pm 9.21$   $\mu$ g/mL,  $p < 0.001$ ); (d) serum glucose ( $4.71 \pm 0.60$  mmol/L versus  $5.12 \pm 0.31$ ,  $p < 0.001$ ); (e) insulin resistance ( $0.98 \pm 0.72$  mmol/L versus  $2.67 \pm 2.19$  mmol/L,  $p < 0.001$ ); and (f) serum vitamin 25(OH)D ( $9.27 \pm 5.81$  ng/mL versus  $28.26 \pm 39.66$  ng/mL,  $p = 0.001$ ); when compared to the general population, respectively (Karras et al., 2019). Unfortunately, as these were only single day comparisons, it is difficult to generalize from the results; however, these findings of significantly better glucose and insulin

regulation amongst the Athonian monks has implications in the mitigation of diseases of modern culture.

With respect to hematological status, a single-arm case study followed 35 generally healthy Orthodox Christian Thessaloniki adults for the Great Lenten fast, which demonstrated: (a) significantly increased ( $p = 0.011$ ) plasma total antioxidant capacity (TAC) ( $0.98 \pm 0.04$  mmol/L) following the fast, when compared to the pre-fasting baseline levels ( $0.84 \pm 0.24$  mmol/L); and (b) significant decreases to coagulation factor VII ( $107.82 \pm 19.15\%$  to  $91.97 \pm 18.43\%$ ,  $p = 0.001$ ) and activated partial thromboplastin time (APTT) ratio ( $1.07 \pm 0.097$  to  $0.91 \pm 0.096$ ,  $p < 0.001$ ) from baseline to post-fast levels (Makedou et al., 2018). The increased consumption of nuts, seeds, and vegetables, with their rich antioxidant, carotenoid, and flavonoid content, likely contributed to the TAC findings.

Another single-arm case study observed 41 generally healthy Orthodox Christian Thessaloniki adult female nuns during the Great Lenten fast and found similar results, i.e., significant decreases to both coagulation factor VII ( $107.82 \pm 19.15\%$  to  $91.97 \pm 18.43\%$ ,  $p = 0.001$ ) and APTT ratio ( $1.04 \pm 0.12$  to  $0.91 \pm 0.09$ ,  $p < 0.001$ ), from the baseline until after the fast, respectively (Liali et al., 2018). These findings are interesting inasmuch as these biomarkers induce different effects on the coagulation process; thus, while there may be a compensatory mechanism that helps to maintain coagulation status, the increase to TAC is the more pertinent factor, regarding cardiovascular health.

Potential concerns arise concerning micronutrient status, particularly calcium, iron, the antioxidant vitamins A and E, the hormone vitamin D, the neuroregulatory

vitamin B12, and the omega-6:omega-3 ratio (Sarri et al., 2004; Sarri et al., 2009; Karras et al., 2017). However, in one longitudinal study, 120 generally healthy Cretan Orthodox Christian adults were followed for one year, voluntarily delineated to fasting and non-fasting arms. Upon completing 24-hour dietary recalls, the fasting group was found to have: (a) significant reductions to the percent of energy derived from saturated fat ( $p < 0.001$ ), dietary cholesterol per 4,184 millijoule (mJ) ( $p < 0.001$ ) and dietary calcium per 4,183 mJ ( $p = 0.001$ ); and (b) significant increases to dietary iron per 4,184 mJ ( $p < 0.001$ ) and folate per 4,184 mJ ( $p = 0.009$ ), compared to the non-fasting control at the end of holy periods (Sarri et al., 2004). From a dietary perspective, by the end of the study, the fasters were found to have consumed significantly more fruits and vegetables ( $p < 0.001$ ) and potatoes ( $p = 0.016$ ), as well as less alcohol ( $p = 0.004$ ), in relation to the control group (Sarri et al., 2004).

While it was presumed that there might be improvements in blood pressure, to date, the evidence is of mixed efficacy, with the associated calcium deficiency being a potential confounding factor (Sarri et al., 2007; Papadaki et al., 2008; Trepanowski & Bloomer, 2010). A longitudinal study followed 67 generally healthy Cretan Orthodox Christians adults for one year, which found significant changes in the non-fasting group for diastolic blood pressure (-2.3 mmHg versus 0.7 mmHg,  $p = 0.021$ ), but not systolic blood pressure (-3.89 mmHg versus -1.8 mmHg,  $p = 0.152$ ), compared to the fasting group. However, as noted before, the lack of analyses for electrolyte intake or serum concentrations make definitive conclusions more difficult.

In a self-referential single-arm case study that followed 10 Orthodox Christian adult male monks for one week each, during a fasting and non-fasting period, which

found the fasting period to exhibit: (a) significant reductions in total fat ( $p = 0.013$ ), saturated fat ( $p = 0.005$ ), and dietary calcium ( $p = 0.022$ ) intake; (b) significant increases in fiber ( $p < 0.001$ ), cholesterol ( $p = 0.005$ ), iron ( $p = 0.008$ ), and folate ( $p = 0.005$ ) intake; (c) significantly lower serum levels of total cholesterol ( $p = 0.005$ ), LDL cholesterol ( $p = 0.005$ ) and triglycerides ( $p = 0.017$ ); and (d) significantly higher systolic blood pressure ( $p = 0.012$ ); when compared to the non-fasting week (Papadaki et al., 2008). Moreover, 7-day weighed dietary records found significant increases in the consumption of legumes ( $p = 0.005$ ), and fish and seafood ( $p = 0.009$ ), as well as significant decreases in the intakes of milk and yogurt ( $p = 0.027$ ), cheese ( $p = 0.008$ ), eggs ( $p = 0.012$ ) and meat ( $p = 0.008$ ), during the fasting week when compared to the non-fasting week (Papadaki et al., 2008). Thus, while there were some improvements in dietary patterns and to the blood lipid profile, there were also potential issues with calcium status and blood pressure. Considering this, electrolyte balance (particularly calcium and potassium intake) is of high importance during fasting protocols (Koufakis et al., 2018).

Although there are decreases in heme iron intake, iron deficiency is not a common finding as ample intakes of dark green cruciferous vegetables and vitamin C-rich fruits and vegetables appear to make up for the difference (Koufakis et al., 2017; Persynaki, Karras, & Pichard, 2017). In particular, a focus on the Mediterranean dietary patterns are essential for the mitigation of iron-deficiency concerns, as the inclusion of vegetables, nuts, lentils, and other legumes, as well as shellfish, can adequately provide sufficiency (Sarri et al., 2005; Savva & Kafatos, 2014; Koufakis et al., 2017). In a longitudinal study, 59 generally healthy Cretan Orthodox Christians adults were examined during the

40 days of the Nativity Fast, which found significant increases in serum ferritin: ( $p = 0.020$ ) and significant decreases in total iron-binding capacity ( $p < 0.001$ ), in the fasting group, when compared to the non-fasters (Sarri et al., 2005). Moreover, when females were analyzed separately, these findings retained their significance, at values of  $p < 0.001$  and  $p = 0.015$ , respectively (Sarri et al., 2005). These beneficial effects on iron status are particularly promising as women are an especially vulnerable population, concerning iron deficiency.

Additionally, while there are significant reductions to dietary intake of vitamin B12 during fasting periods, the majority of the current literature has found serum levels of fasters to be sufficient (Lazarou & Matalas, 2010; Koufakis et al., 2017; Karras et al., 2019). Since fasting does not appear to induce deficiency in the short-term, this further illustrates the necessity for cyclical interventions, to avoid necessitating supplementation. Similarly, although dietary intakes of the antioxidant vitamins A and E were slightly reduced during the 40 days fasts, resulting in decreased serum levels, this was not correlated with standards consistent with deficiency (Sarri et al., 2009). This longitudinal study examined the micronutrient status of 85 generally healthy Cretan Orthodox Christian adults during the period of the Nativity fast (Sarri et al., 2009). Despite the fasting group experiencing significant decreases ( $p < 0.001$ ) in serum levels of retinol and  $\alpha$ -tocopherol, when compared to the non-fasting control group, their end concentrations of  $4.4 \pm 0.9 \mu\text{mol/L}$  and  $36.7 \pm 5.0 \mu\text{mol/L}$  are well above the deficiency states of  $0.35 \mu\text{mol/L}$  and  $0.2 \mu\text{mol/L}$ , respectively (Sarri et al., 2009).

The inclusion of seafood also helps to mitigate concerns for omega-3 insufficiency. Moreover, evidence has found that populations that maintain Orthodox

Christian dietary practices exhibit adipose levels of the omega-3 polyunsaturated fatty acid, docosahexaenoic acid (DHA), sufficient for protection against depression and other chronic diseases (Sarri et al., 2008). In this longitudinal study, 51 generally healthy Cretan Orthodox Christian adults were followed for one year (Sarri et al., 2008). The fasting group exhibited significantly higher levels of DHA in their adipose tissue ( $p = 0.047$ ), but not significantly different depression symptoms ( $8.4 \pm 4.5$  versus  $6.3 \pm 5.6$ ) in the fasting and non-fasting arms, respectively, with both being below the cut-off score of 10 (Sarri et al., 2008). However, it was also demonstrated that there is a significant ( $p = 0.018$ ) inverse relationship between adipose DHA concentrations and depression (Sarri et al., 2008). Thus, while there were no significant differences between the groups in depression incidence in this smaller sample, increased consumption of DHA is still likely to have a positive impact in reducing depression on the population level.

An interesting secondary finding in Orthodox fasting populations is the role of seafood and plant-based protein in reducing plasma levels of amino acids associated with diabetes risk (Elshorbagy et al., 2017). This case study examined the blood lipid and amino acid profiles 36 sedentary Egyptian Orthodox Christians over a 6-week period, during the Nativity fast, which found significant reductions to: (a) serum total cholesterol ( $-14 \pm 5$  mg/dL,  $p < 0.001$ ); (b) serum LDL cholesterol ( $-13 \pm 6$  mg/dL,  $p < 0.001$ ); (c) plasma leucine ( $-13\%$ ,  $p < 0.001$ ); (d) plasma isoleucine ( $-10\%$ ,  $p < 0.01$ ); and (e) plasma valine ( $-19\%$ ,  $p < 0.001$ ); when compared to their baseline pre-fasting levels (Elshorbagy et al., 2017).

**Limitations of Orthodox Christian Fasting.** This method of fasting poses a primary concern for researchers when it pertains to the health of vulnerable populations,

e.g., pregnant and lactating women, young children, and the elderly (Bazzano, Potts, & Mulugeta, 2018; Desalegn et al., 2018; 2019; Kumera, Tsedal, & Ayana, 2018). In a longitudinal study, 572 Orthodox Tewahedo Christian Ethiopian adult lactating mothers were observed during the period of Great Lent and a non-fasting period, separated by their fasting or non-fasting status (Desalegn et al., 2018). The authors demonstrated: (a) significant reductions to diet diversity in both the fasting ( $2.5 \pm 0.54$  versus  $2.69 \pm 0.68$ ,  $p = 0.037$ ) and non-fasting mothers ( $2.63 \pm 0.53$  versus  $2.73 \pm 0.55$ ); during the Lenten period compared to the non-fasting period, respectively (Desalegn et al., 2018). However, as both fasters and non-fasters displayed low dietary diversity scores ( $< 4$ ) during both periods, it is worth noting that economic and environmental factors may play a more substantive role.

Another longitudinal study by the same research group examined 567 infants (aged 6-23 months) of Tewahedo Christian Ethiopian mothers for dietary intakes and developmental status, which found the weight-for-age ( $-1.25 \pm 1.15$  versus  $0.77 \pm 1.09$ ,  $p < 0.001$ ) and height-for-age ( $-1.60 \pm 1.35$  versus  $-1.24 \pm 1.34$ ,  $p = 0.003$ ) to be significantly lower in the children of mothers who participated in Lenten fasting, when compared to those who did not, respectively (Desalegn et al., 2019).

Similarly, a prospective, cross-sectional study, observed 967 infants (aged 6-23 months) of Tewahedo Christian Ethiopian mothers were examined for dietary diversity, which found 86.4% of the children did not meet minimum dietary diversity, with a mean score of  $3.13 \pm 0.87$  (Kumera, Tsedal, & Ayana, 2018). In those that were low ( $< 4$ ), fasting status accounted for 54.8% and economic status 45.2%, of the primary reason for abstention from animal foods, which contributed to the low diversity scores (Kumera,



Tsedal, & Ayana, 2018). Collectively, these findings indicate that although fasting demonstrates a significant effect in reducing dietary diversity and overall intakes, it is difficult to generalize these results to larger populations, without accounting for economic factors.

Moreover, unfortunately, much of the research in this area has been primarily conducted in the Ethiopian Orthodox Tewahedo Christian population, which is an Oriental Orthodox Christian denomination, whereas the focus here is on Eastern Orthodoxy. The theological distinctions are beyond the scope of this paper, but it should be noted that the Church Fathers were rather clear that the fasting is not meant to be interpreted in a legalistic fashion (i.e., punishment if not done), but rather to achieve *metanoia*.

Accordingly, St. Basil advised that, “With reference to food, as individual needs vary according to age, employment, and physical condition, respectively, so the manner of its use and the amount of it differ... As regards nourishment to be given the sick for their relief... prescribe according to the need...” (Schopp, 2012, p. 275). Evagrius Ponticus also stated that ascetic practices should be undertaken “according to due measure and at the appropriate times” and that “...when you are ill you should modify your ascetic labors for the time being, so that you may regain the strength to take them once more” (Harakas, 1990, pp. 33, 39). Moreover, “... though all Orthodox Christians are urged to fast, it is not permitted for one who is ill to fast so as to cause physical harm to himself or herself” (Harakas, 1990, p. 95). Thus, those that are pregnant, lactating, under the age of 7 years old, elderly, or otherwise infirmed are doing so of their own accord, not in congruence with traditional teachings. Moreover, the literature finds that

in Greek Orthodox Christian populations, for children, dairy is one of the most often relaxed restricted food, particularly for calcium and protein intake (Lazarou & Matalas, 2010).

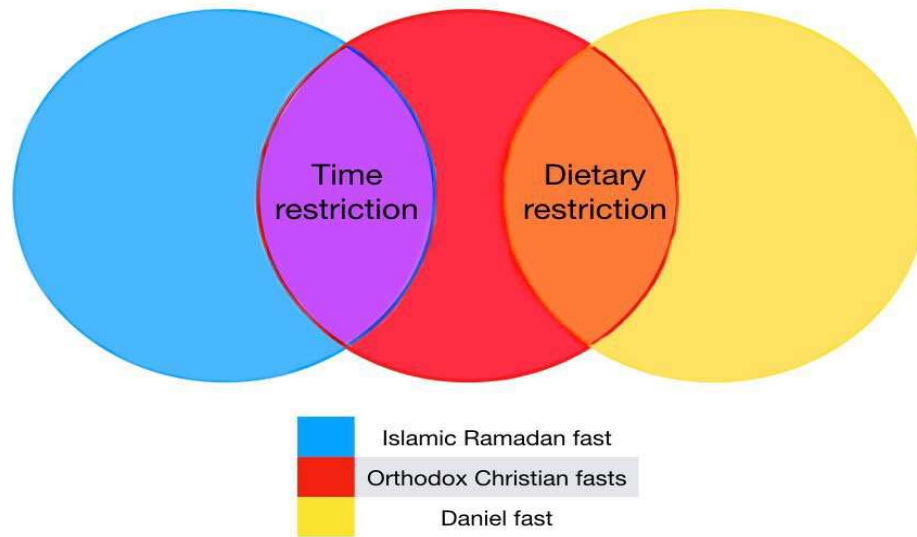
One other population-specific issue found was hypovitaminosis D in Athonian Orthodox Christian monastics, as their dark clothing likely impedes their ability to synthesize vitamin D (Karras et al., 2017; Koufakis et al., 2017; 2018). As such, given the lower dietary intakes during fasting periods, it is crucial to be mindful of increasing sun exposure, or through supplementation if necessary.

Of additional note, there is also the concern for fasting and other ascetic practices in the development of anorexia and other issues of mental health; however, the recent literature has found that higher degrees of R/S are protective against body image problems, disordered eating patterns and psychopathology (Boisvert & Harrell, 2013; Akrawi et al., 2015). However, this is explicitly for intrinsic religiousness, i.e., deep spiritual connection, as is attempted to be fostered through Orthodox Christian ascetic practices. Conversely, extrinsic religiousness, i.e., more superficial practices for social or personal gain, is related to increased rates of eating disorders and psychopathology (Boisvert & Harrell, 2013; Castellini et al., 2014).

### **Other Religious Fasting.**

Fasting is a nearly universal practice in religious and secular cultures throughout the world (Longo & Mattson, 2014; Golbidi et al., 2017; Persynaki, Karras, & Pichard, 2017). Extensive research has been conducted on other faiths, including Orthodox Jews, Muslims, Buddhists, Hindus, Seventh-Day Adventist Christians, and other Protestant Christians (Trepanowski & Bloomer, 2010; Trepanowski et al., 2011; Persynaki, Karras,

& Pichard, 2017; Venegas-Borsellino, Sonikpreet, & Martindale, 2018). In particular, Islamic fasting and the Daniel Fast most closely resemble that of Orthodox Christian fasting, as seen in Figure 2.



*Figure 2.* Religious fasting Venn diagram with similarity overlap.

**Ramadan Fasting.** Islamic fasting is based predominately around the 29-40-day celebration of Ramadan, whereby it is an intermittent fasting methodology consisting of total abstention from food and drink between daylight hours (Sarri et al., 2007; Patterson et al., 2015; Venegas-Borsellino, Sonikpreet, & Martindale, 2018). From a physiological perspective, this results in shifts to circadian biology, particularly substrate utilization and metabolic hormone rhythms (e.g., cortisol, ghrelin, insulin, and leptin), which can have significant effects on metabolism (Lessan et al., 2018; Alam et al., 2019; Lessan & Ali, 2019).

In an open-label, longitudinal follow-up cohort study, 78 generally healthy Pakistani Muslim adults were followed during the period during and after Ramadan,

which demonstrated significant reductions to: (a) bodyweight ( $63.7 \pm 14.8$  kg versus  $66.4 \pm 14.8$  kg versus  $67.5 \pm 15.0$  kg,  $p < 0.0001$ ); (b) systolic blood pressure ( $124.2 \pm 22.9$  mmHg versus  $130.0 \pm 22.6$  mmHg versus  $140.6 \pm 25.9$  kg,  $p < 0.0001$ ); and (c) diastolic blood pressure ( $102.9 \pm 25.6$  mmHg versus  $106.2 \pm 24.8$  mmHg versus  $107.6 \pm 24.5$  mmHg,  $p < 0.0001$ ); as well as (d) triglycerides ( $p < 0.0001$ ), fasting glucose ( $p < 0.0001$ ), and leptin: ( $p = 0.0102$ ); as compared to their baseline (Alam et al., 2019). However, it should be noted that although still lower than their pre-fasting levels, there was a rebound effect on weight and blood pressure in the period after the fasting.

Unfortunately, due to consequent reductions in activity levels and sleep patterns, there does not appear to be much change in total energy expenditure (TEE) or resting metabolic rates (RMR), during the Ramadan period (Ajabnoor et al., 2014; Lessan et al., 2018). A prospective observational study observed 17 generally healthy Canadian Muslims during the Ramadan period, voluntarily assigned to fasting or non-fasting arms, which established significantly lower: (a) body fat percentage ( $-2.7\%$  versus  $4\%$ ,  $p = 0.020$ ); (b) systolic blood pressure ( $-9.2\%$  versus  $-4.5\%$ ,  $p = 0.037$ ); (c) physical activity, using step count as a proxy ( $6850 \pm 2079$  steps versus  $9685 \pm 7126$  steps,  $p < 0.05$ ); and (d) TEE ( $181 \pm 121$  kcal/d versus  $286 \pm 265$  kcal/d,  $p < 0.05$ ); in the fasters compared to the non-fasters, respectively (Alsubheen et al., 2017).

Conversely, in a prospective crossover study, 29 generally healthy Muslim adults from the UK were examined during Ramadan (Lessan et al., 2018). No significant differences were found in RMR ( $1365.7 \pm 230.2$  kcal/d versus  $1362.9 \pm 273.6$  steps,  $p = 0.713$ ) or TEE ( $2224.1 \pm 433.7$  kcal/d versus  $2121.0 \pm 718.5$  kcal/d,  $p = 0.7695$ ), but did see a significant increase in step count ( $9950 \pm 1152$  steps versus  $11,353 \pm 2054$  steps,  $p$

= 0.001), from Ramadan contrasted to the post-Ramadan period, respectively (Lessan et al. 2018). Thus, while physical activity was significantly reduced by Ramadan fasting in both samples as a regulatory consequence of reduced caloric intake, RMR and overall TEE appear to be conserved.

Although there are improvements in lifestyle choices (e.g., elimination of tobacco and caffeine), dietary choices and caloric intakes are not explicitly articulated. Therefore, the difficulty in standardization can result in confounding variables, e.g., overeating, nutrient imbalances, and dysregulation of glycemic control (Trepanowski & Bloomer, 2010; Venegas-Borsellino, Sonikpreet, & Martindale, 2018). Despite these issues, Ramadan fasting does appear to improve body composition through reductions in body mass and body fat, while retaining lean muscle mass, as well as improvements in blood cardiometabolic profile (Nematy et al., 2012; Norouzy et al., 2013; Sadeghirad et al., 2014; Alsubheen et al., 2017; Fernando et al., 2019).

A prospective observational study assessed the effects of Ramadan fasting on body composition, with 240 generally healthy Iranian Muslim adults, categorized by their sex and age (i.e.,  $\leq 35$  or 36-70 years old), which demonstrated statistically significant reductions to bodyweight and body fat percentage in nearly all four subgroups, namely: (a) young men aged 35 years and under ( $-2.2 \pm 2.2\%$ ,  $p < 0.001$  and  $-2.5 \pm 3.2\%$ ,  $p = 0.029$ ); (b) young women aged 35 years and under ( $-1.4 \pm 2.8\%$ ,  $p < 0.001$  and  $-1.1 \pm 2.8\%$ ,  $p = 0.079$ ); (c) men aged 36-70 years ( $-1.5 \pm 1.3\%$ ,  $p < 0.001$  and  $-1.1 \pm 1.5\%$ ,  $p = 0.012$ ); and (d) women aged 36-70 years ( $-0.8 \pm 2.9\%$ ,  $p < 0.01$  and  $-1.4 \pm 2.8\%$ ,  $p = 0.052$ ); respectively (Norouzy et al., 2012). It is worth noting that the results were more

pronounced in men, particularly young men, and that the effect in older women was only marginally significant at a  $p$ -value of 0.052.

Another prospective observational study examined 82 Iranian Muslim adults, with at least 1 cardiovascular risk factor, before and after the period of Ramadan fasting, which found significant improvements to: (a) coronary heart disease risk score ( $10.8 \pm 7$  versus  $13.0 \pm 8$ ,  $p < 0.001$ ); (b) total cholesterol ( $184.3 \pm 42$  mg/dL versus  $193.4 \pm$  mg/dL,  $p = 0.023$ ); (c) LDL cholesterol ( $96.83 \pm 35$  mg/dL versus  $109.96 \pm 46$  mg/dL,  $p < 0.001$ ); and (d) triglycerides ( $182.9 \pm 112$  mg/dL versus  $224.8 \pm 129$  mg/dL,  $p < 0.001$ ); and (e) systolic blood pressure ( $129 \pm 17$  mmHg versus  $132.9 \pm 16$  mmHg,  $p = 0.03$ ); after fasting, when compared to the baseline (Nematy et al., 2012).

In one more prospective cohort study, 40 hypertensive Egyptian Muslim adults were compared to 40 sex- and age-matched normotensive adults and observed for 3 months, during the Ramadan fasting period, which found: (a) reductions to arterial blood pressure ( $-17.5\%$ ,  $p < 0.05$  versus  $-9.3\%$ ,  $p > 0.05$ ), systolic blood pressure ( $-10.5\%$ ,  $p < 0.05$  versus  $-6.3\%$ ,  $p > 0.05$ ), serum triglycerides ( $-24.5\%$ ,  $p < 0.05$  versus  $-22.8\%$ ,  $p < 0.05$ ), and LDL cholesterol ( $-17.7\%$ ,  $p < 0.05$  versus  $-4.0\%$ ,  $p > 0.05$ ); as well as improvements to: (b) HDL cholesterol ( $33.3\%$ ,  $p < 0.05$  versus  $6.7\%$ ,  $p > 0.05$ ) and blood glutathione ( $56.8\%$ ,  $p < 0.05$  versus  $52.6\%$ ,  $p < 0.05$ ); in the hypertensive versus control groups, respectively (Al-Shafei et al., 2014). While the hypertensive subset reached statistical significance in all of the categories, the generally healthy sample only did for the triglyceride decrease and glutathione increase. The significant elevations to blood glutathione has powerful implications for the reduction of cardiovascular disease through its role in the mitigation of the oxidative stress.

Conversely, in a prospective observational study, which observed 517 Tunisian Muslim adults with 2 or more cardiovascular risk factors before, during and after Ramadan fasting found transient, but statistically significant ( $p < 0.05$ ), negative effects during the Ramadan fasting period to: (a) blood glucose ( $9.09 \pm 0.35$  mmol/L versus  $8.25 \pm 0.34$  mmol/L versus  $8.04 \pm 0.31$  mmol/L); (b) total cholesterol ( $4.67 \pm 0.1$  mmol/L versus  $4.55 \pm 0.1$  mmol/L versus  $4.60 \pm 0.1$  mmol/L); (c) triglycerides ( $1.81 \pm 0.11$  mmol/L versus  $1.58 \pm 0.08$  mmol/L versus  $1.60 \pm 0.09$  mmol/L); and (d) insulin: ( $16.9 \pm 10.4$   $\mu$ UI/L versus  $12.7 \pm 10.5$   $\mu$ UI/L versus  $15.1 \pm 10.4$   $\mu$ UI/L); when compared with both the one-month pre-fasting and post-fasting periods, respectively (Beltaief et al., 2019). However, as assessments for sleep quality and physical activity, as well as the quality of dietary intake, were not conducted, further investigation is required. Despite this, it is worth noting that in a sub-set of only the diabetic participants, HbA<sub>1c</sub> was demonstrated to improve significantly ( $9.0 \pm 0.4\%$  versus  $7.6 \pm 0.2\%$ ,  $p < 0.05$ ) after Ramadan fasting, as compared to the baseline (Beltaief et al., 2019). Other inflammatory biomarkers which demonstrate some benefit from the fasting include c-reactive protein: (CRP), hemoglobin A<sub>1c</sub> (HbA<sub>1c</sub>), tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ) and adiponectin: (Alam et al., 2019; Beltaief et al., 2019; Mushtaq et al., 2019).

A prospective observational study assessed the body composition and glucoregulatory status of 20 generally healthy, young, Muslim, Malaysian adult men, in the period before and after the Ramadan fasting period, which discovered significant reductions to bodyweight ( $-2.4\%$ ,  $p < 0.001$ ), BMI ( $-5.5\%$ ,  $p < 0.001$ ), plasma glucose ( $-12.3\%$ ,  $p < 0.01$ ), plasma insulin: ( $-52.8\%$ ,  $p < 0.01$ ), and plasma adiponectin: ( $-45.6\%$ ,  $p < 0.01$ ), following Ramadan (Gnanou et al., 2015).

However, in another prospective observational study, 23 young, Saudi Arabian Muslim adults were observed before and two weeks into Ramadan fasting (Ajabnoor et al., 2014). During Ramadan, the researchers found: (a) significant increases, in the morning, to insulin resistance ( $4.51 \pm 1.04$  versus  $1.98 \pm 0.24$ ,  $p = 0.010$ ) and serum leptin: ( $16.36 \pm 4.35$  ng/mL versus  $7.01 \pm 2.27$  ng/mL,  $p = 0.001$ ); and (b) significant decreases, in the morning, to serum adiponectin: ( $8.80 \pm 0.57$   $\mu$ mol/mL versus  $11.62 \pm 0.80$   $\mu$ mol/mL,  $p = 0.001$ ); when compared to levels before the fasting period, respectively (Ajabnoor et al., 2014).

Conversely, a prospective observational study examined 42 generally healthy Turkish Muslim adults during the last week of Ramadan fasting, as well as the subsequent week (Mesci et al., 2012). No significant differences were found for serum levels of adiponectin: ( $485.19 \pm 893.12$  ng/mL versus  $286.52 \pm 401.80$  ng/mL,  $p = 0.282$ ), leptin: ( $12.25 \pm 12.27$  ng/mL versus  $11.56 \pm 12.27$  ng/mL), or ghrelin: ( $15.18 \pm 19.82$  pg/mL versus  $24.07 \pm 33.66$  pg/mL), respectively (Mesci et al., 2012). However, while not reaching significance, adiponectin levels were around 50 percent higher during the Ramadan fasting (Mesci et al., 2012).

Another prospective cross-sectional study followed 100 generally healthy Pakistani adults of varying body weights during the month of Ramadan (Mushtaq et al., 2019). The participants were categorized by sex and as normal weight, overweight or obese (Mushtaq et al., 2019). This study demonstrated: (a) significant increases to plasma adiponectin in overweight men ( $18.90 \pm 5.85$   $\mu$ g/mL versus  $13.90 \pm 5.04$   $\mu$ g/mL,  $p < 0.05$ ), obese men ( $16.83 \pm 4.68$   $\mu$ g/mL versus  $12.76 \pm 2.48$   $\mu$ g/mL,  $p < 0.001$ ), and obese women ( $17.3 \pm 4.46$   $\mu$ g/mL versus  $14.06 \pm 4.01$   $\mu$ g/mL,  $p < 0.01$ ); (b) no



significant changes to plasma adiponectin in the overweight women or normal weight individuals of either sex; (c) significant reductions to plasma TNF- $\alpha$  in obese men ( $30.20 \pm 10.17$  pg/mL versus  $36.06 \pm 9.30$  pg/mL,  $p < 0.05$ ) and obese women ( $27.17 \pm 7.34$  pg/mL versus  $30.49 \pm 7.98$  pg/mL,  $p < 0.01$ ); and (d) no significant changes to plasma TNF- $\alpha$  in normal and overweight populations of either sex; as compared to their baseline levels before the fast, respectively (Mushtaq et al., 2019). Alam et al. (2019) also found significant reductions to TNF- $\alpha$ , both during (-26.3%,  $p = 0.001$ ) and after (-9.6%,  $p = 0.003$ ) Ramadan fasting, as compared to the baseline pre-fasting levels; however, c-reactive protein, although significantly lowered during fasting ( $1.89 \pm 0.25$  mg/L versus  $3.03 \pm 0.84$  mg/L,  $p < 0.0001$ ), increased to higher than baseline levels ( $3.14 \pm 0.84$  mg/L) during the testing after Ramadan.

Taken together, these results illustrate the complex regulatory role adiponectin may play in fasting concerning body weight. There were differential effects, based on the bodyweight of the individual, with the most pronounced beneficial effects occurring in the overweight and obese. This ability is further evidenced by Gnanou et al. (2015), who found adiponectin level decreases to positively correlate with losses of bodyweight ( $r = 0.45$ ,  $p < 0.45$ ). Additionally, as previously noted, quality of sleep and dietary choices need to be further investigated before less ambiguous conclusions can be reached.

***Limitations of Ramadan Fasting.*** In a nonrandomized, prospective, observational pilot study, 148 Iranian Muslim adults with coronary artery disease were observed in the period during and around the month of Ramadan (Mousavi et al. 2014). No significant differences were found in chest pain (6.1% versus 9.8%,  $p = 0.42$ ) or chest pain with dyspnea (6.1% versus 13.4%,  $p = 0.14$ ), in fasters compared to non-fasters, respectively

(Mousavi et al. 2014). Although they did not reach statistical significance, the positive trend regarding symptomology in the fasting group indicates that these results are promising insomuch as they provide further validation for the potential use of fasting in vulnerable populations, without instigating adverse effects.

Similar to the Orthodox Christian fasting practices, pregnant Muslim women are also exempt from Ramadan fasting (Savitri et al., 2018; Safari, Piro, & Ahmad, 2019). Despite this, there has been a considerable amount of research conducted into the birth outcomes of this population, which have yielded very positive results (Awwad et al., 2012; Petherick, Tuffnell, & Wright, 2014; Glazier et al., 2018; Savitri et al., 2018; Safari, Piro, & Ahmad, 2019).

One case-control study that examined the effects of Ramadan fasting, on 301 Iraqi Muslim adult pregnant women, found: (a) a significantly reduced incidence of gestational diabetes (2.58% versus 8%,  $p = 0.03$ ); and (b) no significant difference in rates of preterm births (4.51% versus 3.42%,  $p = 0.5$ ); between the fasting and non-fasting groups, respectively (Safari, Piro, & Ahmad, 2019). Similarly, an earlier prospective cohort study observed 468 Lebanese Muslim adult pregnant women with respect to Ramadan fasting and found: (a) preterm birth incidence to not significantly differ (11.9% and 10.9%,  $p = 0.5$ ) between fasters and non-fasters, respectively; and (b) significantly lower birth weights ( $p = 0.024$ ) amongst fasting mothers ( $3094 \pm 467$  g), compared to non-fasting mothers ( $3202 \pm 473$  g) (Awwad et al., 2012). However, this effect disappeared upon logistic regression analysis, which determined an odds ratio of 0.43, 95% confidence interval 0.20-0.93,  $p = 0.33$  (Awwad et al., 2012).

Moreover, another prospective cohort study on 1351 Indonesian Muslim adult pregnant women, which compared fasting mothers with non-fasters, found no significant differences to newborn birth weights ( $3107.5 \pm 545.7$  g versus  $3022.4 \pm 545.7$  g,  $p = 0.44$ ), respectively (Savitri et al., 2018). In one other prospective cohort study, which followed 310 pregnant Muslim women in the UK, no significant differences were found for preterm birth incidence (3.1% versus 3.5%,  $p = 0.71$ ) or newborn birth weight ( $3219.3 \pm 534.4$  g versus  $3133 \pm 467$  g,  $p = 0.25$ ), with fasting mothers compared to non-fasting mothers, respectively (Petherick, Tuffnell, & Wright, 2014). Collectively, these results indicate that despite the caution advocated for by both Islamic and Orthodox Christian tradition, there may still be a role for the use of fasting in populations of pregnant women. However, given their vulnerable status, it would be prudent to conduct more research before making any declarative statements.

Unfortunately, many of these changes appear to be limited to the fasting periods, which, as it is only for one month annually, may be suboptimal for long-term health (Sadeghirad et al., 2014; Alsubheen et al., 2017; Fernando et al., 2019). Regardless, as there does appear to be some benefit, primarily mediated by religiosity and degree of adherence, this modality would be best suited for comparing the intermittent fasting aspects (Alam et al., 2019).

**Daniel Fast and Other Faiths.** The Daniel Fast is a popular Protestant methodology based on the Biblical story of Daniel that most closely mimics Orthodox Christian fasting dietary restrictions and spiritual advice, but as a more *ad libitum* modality, does not incorporate the same degree of asceticism (Trepanowski et al., 2011). Thus, it is focused more on dietary restriction, rather than explicit caloric restriction, but

the latter often happens by proxy (Persynaki, Karras, & Pichard, 2017). It represents a potential avenue for comparing cardiovascular and metabolic biomarkers, oxidative stress, as well as quality of life (Trepanowski et al., 2011). However, another area of focus is the more substantial prohibition on modern processed foods, e.g., white flour, sweeteners, alcohol, preservatives, additives, and colorings, as these are areas not explicitly delineated in the Orthodox Christian methodology (Venegas-Borsellino, Sonikpreet, & Martindale, 2018).

Although comprehensive examination into the other faiths is beyond the scope of this paper, a common feature is a focus on the spiritual dimension (Venegas-Borsellino, Sonikpreet, & Martindale, 2018). Thus, as these faiths do also help to provide a *telos* for the individual, there is a potential benefit, but it is still essential to optimize food choices within the established frameworks. However, as previously stated, and subject to further exploration, they lack much of the same logical and metaphysical foundations seen in Orthodox Christianity. As these populations have some methodological crossover and have exhibited similar improvements in healthy lifestyle choices, blood lipid biomarkers, and potential concerns regarding micronutrient status, the data provides further empirical evidence, until additional work is done explicitly from the Orthodox framework (Sarri et al., 2004; Persynaki, Karras, & Pichard, 2017; Venegas-Borsellino, Sonikpreet, & Martindale, 2018).

### **Intermittent Fasting.**

Intermittent fasting (IF) has rapidly become a popular dietary pattern in the health world, and the animal and clinical literature is ever-expanding. Preclinical research in rats has found significant benefits in inflammation reduction, insulin sensitivity, and

insulin-like growth factor signaling, stress response, and induction of autophagy (Longo & Mattson, 2014; Persynaki, Karras, & Pichard, 2017; Paoli et al., 2019). Moreover, in humans, IF and caloric restriction (CR) has been associated with improvements in both quality of life and longevity, including improvements to chronic degenerative diseases, cardiometabolic diseases, and reductions to tumor growth, as well as modulation of the microbiome (Horne, Muhlestein, & Anderson, 2015; Patterson et al., 2015; Venegas-Borsellino, Sonikpreet, & Martindale, 2018; de Groot et al., 2019; Malinowski et al., 2019; Wilhelmi de Toledo et al., 2019). Regarding cancer specifically, intermittent fasting appears to improve both tolerance to and efficacy of chemotherapy, thus making it a potentially useful adjunct to those electing to go on conventional medical treatments (Longo & Mattson, 2014; Bauersfeld et al., 2018; de Groot et al., 2019).

As previously addressed, intermittent fasting has near-universal, cross-cultural implementation worldwide, primarily for spiritual purposes, but from a purely physiological perspective, many disease states, e.g., infection, induce in an endogenous anorexic response. Moreover, from the materialist framework, this likely represents an adaptive response that reallocates resources away from the pathological agent that is maladapted to non-glucose substrates (Fond et al., 2013). During periods of intermittent fasting, there is a shift in energy metabolism from predominately glucose-based, to increased fatty acid oxidation, with the subsequent induction of a ketogenic state (Harvie et al., 2013; Solianik et al., 2016; Stockman et al., 2018). In the initial stages, glycogen stores are mobilized (generally after 12 hours without food intake through the initiation of ketogenesis), which, when depleted, results in lipolytic action upon body fat mass, concluding with protein catabolism (Fond et al., 2013; Anton et al. 2018).

However, an additional potential mechanism for the therapeutic benefits associated with intermittent fasting is through the role of sirtuins, a class of signaling molecules whose activity correlates with aging, inflammation, metabolism and, chronic disease development, principally through their regulation of mitochondrial biogenesis (Michan & Sinclair, 2007; Zhu et al., 2013; Bonkowski & Sinclair, 2016; Kupis et al., 2016; Grabowska, Sikora, & Bielak-Zmijewska; 2017). Although controversial, there is evidence that caloric restriction, e.g., intermittent fasting, can upregulate their activity through increases to nicotinamide adenine dinucleotide + (NAD<sup>+</sup>), which may mediate some of the health benefits associated with intermittent fasting (Villalba, & Alcáin, 2012; Dang, 2014; Zullo et al., 2018; Palmeira et al., 2019). Unfortunately, while much of the research on sirtuins has moved towards utilizing nutrients and pharmaceuticals for their activation, there is still much room for further clinical investigations into their role in the therapeutic efficacy of fasting (Guarente, 2013; Dai et al., 2018; Kane & Sinclair, 2018).

Clinically, a variety of methods have been developed, including intermittent energy restriction (IER), alternate day fasting (ADF), time-restricted feeding (TRF), the “5:2 diet,” once-weekly water fasting, and juice/broth fasts (Patterson et al., 2015; Antoni et al., 2017; Anton et al., 2018; Cioffi et al., 2018; Grajower & Horne, 2019). A summary of some of the relevant trials are seen in Table 5.

Intermittent energy restriction represents a protocol that reduces calories for a certain period, followed by normal caloric intake (Harvie & Howell, 2017). When compared to a calorically reduced Mediterranean-style diet, women adhering to a Mediterranean-style IER diet, with or without concurrent *ad libitum* protein and fat consumption, were found to have improvements to insulin sensitivity and body adiposity,

with minimal effects to micronutrient status (Harvie et al., 2013). This randomized active-control trial followed 115 overweight and obese women for three months, with a 1-month follow-up period, assigning them into one of three groups: (1) intermittent energy and carbohydrate restriction (IECR) of ~25%; (2) IECR with *ad libitum* protein and fat (IECR + PF), which resulted in a ~15% energy reduction in practice; or (3) daily energy restriction (DER) of ~25% (Harvie et al., 2013). At the end of which, both IECR groups significantly decreased body fat at a higher rate than the DER group, at rates of (a)  $-3.7 \pm 1.2$  kg (95% CI),  $p = 0.007$ , for the IECR; and (b)  $-3.7 \pm 1.1$  kg (95% CI),  $p = 0.019$ , for the IECR + PF; compared to: (c)  $-2.0 \pm 1.0$  kg (95% CI), for the DER (Harvie et al., 2013).

Another Mediterranean-style IER (IER-MED) trial demonstrated a reduction in visceral and total body fat in overweight and obese East-Asian men and women (Panizza et al., 2019). In this randomized, active comparator trial, 60 adults were recruited in Hawaii and examined for 12 weeks, delineated into either: (1) an IER-MED, with 70% energy reduction for two consecutive days, with five days euenergetic; or (2) a euenergetic Dietary Approaches to Stop Hypertension (DASH) diet (Panizza et al., 2019). The study demonstrated statistically significant decreases to visceral adipose tissue (VAT) ( $-22.6 \pm 3.6$  cm<sup>2</sup> versus  $-10.7 \pm 3.5$  cm<sup>2</sup>, 95% CI,  $p = 0.02$ ) and total body fat ( $-3.3 \pm 0.4$  kg versus  $-1.6 \pm 0.4$  kg, 95% CI,  $p = 0.005$ ), in the IER-MED group, when compared to the DASH arm, respectively (Panizza et al., 2019). While not directly applicable to the Orthodox Christian mode of fasting, this methodology is sufficiently similar to provide a theoretical basis for further investigation.

However, a recent longer-term trial with overweight and obese adults, comparing two forms of IER to regular caloric restriction, did not replicate these results (Headland, Clifton, & Keogh, 2018). While both types of IER produced decreases in body fat and triglycerides, there was no significant difference in body composition, weight loss, or cardiometabolic biomarkers (Headland, Clifton, & Keogh, 2018). This randomized control trial followed 332 overweight and obese Australian adults, predominantly women, for one year, allocating the subjects to one of three arms: (1) continuous energy restriction (CER); (2) week-on-week-off (WOWO) alternating CER; or (3) 5:2 modified fast (Headland, Clifton, & Keogh, 2018). The authors did not produce significantly different results for weight loss between any of the three groups, at  $-6.6 \pm 1.6$  kg,  $-5.1 \pm 1.6$  kg,  $-5.0 \pm 1.4$  kg, for the CER, WOWO, and 5:2, respectively (Headland, Clifton, & Keogh, 2018). Unfortunately, only 146 individuals completed the trial, as all three groups lost at least 49% of their participants. Thus, it is important to consider the high dropout rate, which the authors conceded, when evaluating the results of this study.

The 5:2 diet denotes a specific variation on IER whereby caloric intake is severely limited for two non-consecutive days, with standard *ad libitum* eating on the remaining days (Conley et al., 2018). While not directly applicable, this methodology closely resembles the Orthodox Christian practice of weekly semi-vegetarian fasting on most Wednesdays and Fridays; thus, it may provide some insight. A recent study in obese men found the protocol to reduce weight, waist circumference, and systolic BP; however, not at a level significantly different than a standard energy-restricted diet (SERD) (Conley et al., 2018). In this randomized control, pilot trial, 24 obese Australian male war veterans were examined for six months, allocated to either 5:2 IER or SERD groups (Conley et al.,



2018). No primary outcome measures reached significant difference between groups for: (a) weight loss,  $5.3 \pm 3.0$  kg (5:2) versus  $5.5 \pm 4.3$  kg (SERD); (b) waist circumference,  $8.0 \pm 4.5$  cm (5:2) versus  $6.4 \pm 5.8$  cm (SERD); or (c) systolic blood pressure, 14 mmHg (5:2) and 10.2 mmHg (SERD) (Conley et al., 2018).

Another trial in overweight and obese individuals found superior benefits against hypertension and postprandial lipaemia response, i.e., blood lipids after eating, in those following a 5:2 diet (Antoni et al., 2018). This randomized control trial followed 27 overweight and obese adults in the UK, until the point at which 5% of body weight was lost, or until a maximum time allotment of nine months (Antoni et al., 2018). These participants were distributed into two groups, either 5:2 IER or CER, with the IER group demonstrating significant improvements compared to the CER, including: (a) 40% reductions in postprandial triglyceride response; and (b) systolic blood pressure reductions of  $-6 \pm \text{five mmHg}$  (95% CI),  $p = 0.02$  (Antoni et al., 2018).

Similarly, a pilot study in overweight and obese diabetic individuals found improvements in weight reduction and glycemic control (Carter, Clifton, & Keogh, 2016). In this randomized control pilot trial, 63 overweight and obese, type 2 diabetic, Australian adults were allocated to either a 5:2 IER or CER group and observed for 12 weeks (Carter, Clifton, & Keogh, 2016). The authors demonstrated significant reductions in both groups, but not between treatments, for: (a)  $\text{HbA}_{1c}$ ,  $-0.6 \pm 0.8\%$  (IER) and  $-0.8 \pm 1.0\%$  (CER),  $p = 0.3$ ; and (b) total fat mass,  $-3.8 \pm 2.7$  kg (IER) and  $-4.0 \pm 3.2$  kg (CER),  $p = 0.8$  (Carter, Clifton, & Keogh, 2016). The same researchers repeated these results, with a randomized control, noninferiority trial on 5:2 IER versus CER, which followed a larger sample ( $n = 137$ ) of overweight and obese, Australian adults with type 2 diabetes

mellitus (T2DM), for a longer period (1 year) (Carter, Clifton, & Keogh, 2018). Once again, significant improvements were found within-groups, but not significantly between-groups for: (a) HbA<sub>1c</sub> reduction, -0.3% [SEM 0.1%] (IER) and -0.5 [SEM 0.2%] (CER), 90% CI,  $p = 0.65$ ; and (b) total fat mass reduction,  $-4.7 \pm 1.4$  kg (IER) and  $-3.4 \pm 1.2$  kg (CER),  $p = 0.2$  (Carter, Clifton, & Keogh, 2018). These results indicate that intermittent fasting can represent a beneficial alternative to continuous dietary restriction, particularly for those individuals who are difficult to convince otherwise.

One more pilot study recently examined overweight, but not obese, men and women during the holiday period, whereby the individuals followed a 5:2 IER diet throughout a 52-day “holiday period” from Thanksgiving to New Year (Hirsch et al., 2019). The protocol was found to improve bodyweight and blood lipid regulation (Hirsch et al., 2019). In this randomized control pilot trial, 22 overweight adults from Florida were assigned to one of two groups: (1) 5:2 intermittent energy-restricted diets, consisting of 730 calories of supplemental shakes, for two days per week, along with five days of habitual eating; or (2) control group consisting of the participants’ regular diet, along with a multivitamin: (Hirsch et al., 2019). The participants demonstrated significant improvements to: (a) body weight ( $-1.3 \pm 1.1$  kg versus  $-0.4 \pm 0.9$  kg); and (b) total cholesterol:HDL ratio ( $-0.3 \pm 0.2$  versus  $0.02 \pm 0.25$ ), in the intervention group as compared to the control group, respectively (Hirsch et al., 2019). This study is particularly interesting inasmuch as it nicely coincides with the Orthodox Christian 40-day Nativity fasting period, which is also a portentous time for weight gain in the general Western population. However, a potential limitation of this trial was that it was conducted by and followed a protocol designed by a supplement manufacturer.

Alternate day fasting represents another variation on the IER protocol, whereby individuals consume a time-restricted, calorically reduced diet on non-sequential days (Ganesan, Habboush, & Sultan, 2018). One ADF trial in non-obese men and women demonstrated an ability to reduce body fat, while improving cardiovascular biomarkers (Varady et al., 2013). This randomized control trial followed 32 normal weight and overweight adults from Chicago for 12 weeks, assigning them into either: (1) an ADF protocol, which reduced calories to 25% of their energy needs on “fast days,” alternated by *ad libitum* eating; or (2) control group, which allowed for *ad libitum* eating every day (Varady et al., 2013). There were: (a) significant reductions in body fat for the ADF arm ( $-3.6 \pm 1$  kg,  $p = <0.001$ ); and (b) reductions to LDL cholesterol ( $-18.4 \pm 6$  mg/dL) and triglycerides ( $-22 \pm 11$  mg/dL), in the ADF group, but the change to triglycerides was only marginally significant, at  $p = 0.06$  (Varady et al., 2013).

Similarly, a study examining obese individuals found body fat and cardiovascular improvements, particularly when paired with endurance exercise (Bhutani et al., 2013). In this randomized control, parallel-arm trial separated 64 obese adults in Chicago into one of four groups: (1) ADF, with a 75% energy reduction, paired with a 2-hour time-restricted window, on “fast” days and *ad libitum* consumption on ‘feed days;’ (2) combination, ADF + endurance exercise program three days per week; (3) exercise only, three days per week, with *ad libitum* diet; or (4) control group, with no exercise and *ad libitum* diet (Bhutani et al., 2013). After being followed for 12 weeks, the authors discovered: (a) significant decreases in body fat for the ADF only and combination groups ( $-2 \pm 1$  kg and  $-5 \pm 1$  kg, respectively,  $p = <0.001$ ); and (b) improvements to blood lipid profile in the ADF and combination groups (Bhutani et al., 2013). However, only

the combination group reached significance for lowering LDL ( $-12 \pm 5$  mg/dL,  $p = 0.043$ ) lowered and elevating HDL ( $18 \pm 9$  mg/dL,  $p = 0.041$ ) (Bhutani et al., 2013). An exciting aspect of this design was that for the first four weeks, the active ADF participants received their fast day meals prepared by a nutrition clinic, followed by eight weeks of directed guidance for the fasting day meal preparations.

Another ADF trial also found significant improvements to body mass and composition, cardiovascular biomarkers, fasting glucose, without subsequent recidivism 24 weeks following termination of the intervention (Catenacci et al., 2016). This randomized pilot trial observed 26 obese adults from Colorado for eight weeks, along with a 24-week follow-up period (Catenacci et al., 2016). The participants were divided into either: (1) a zero-calorie ADF, which alternated days of no food consumption, with provided meals based on estimated energy requirements (EER), along with *ad libitum* optional meals; or (2) caloric restriction group, of a daily reduction of 400 calories off of their EER (Catenacci et al., 2016). There was (a) significant ( $p < 0.001$ ) absolute weight loss for both the ADF ( $-8.2 \pm 0.9$  kg) and CR ( $-7.1 \pm 1.0$  kg), but a marginally significant ( $p = 0.056$ ) relative weight loss for the ADF ( $-8.8 \pm 0.9\%$ ) versus the CR ( $-6.2 \pm 0.9\%$ ); and (b) significant reduction ( $p = 0.031$ ) in triglycerides for the ADF ( $-25 \pm 10.9$  mg/dL), but not the CR ( $-2.8 \pm 11.3$  mg/dL) group (Catenacci et al., 2016).

While looking to see if the timing of food intake is essential in ADF, a randomized trial on obese individuals found similar improvements to body and visceral fat mass and systolic blood pressure, regardless of when the meals were consumed (Hoddy et al., 2014). In this randomized control, parallel-arm trial 74 obese adults from Chicago were followed for eight weeks and assigned to one of three types of ADF

protocols, which all reduced caloric intake by 75% on fasting days and allowed for *ad libitum* on “feeding days,” but varied on meal timing (Hoddy et al., 2014). The timing was varied as such: (1) ADF-lunch (ADF-L), fast day meals consumed between 12 – 2 PM; (2) ADF-dinner (ADF-D), fast day meals consumed between 6 – 8 PM; or (c) ADF-small meals (ADF-SM), fast day meals further divided into three windows at 6 – 8 AM, 12 – 2 PM, and 6 – 8 PM; which found significant decreases in: (a) all three groups for bodyweight ( $-3.5 \pm 0.4$  kg,  $-4.1 \pm 0.5$  kg,  $-4.0 \pm 0.5$  kg) and visceral fat mass ( $-0.75 \pm 0.027$  kg,  $-0.135 \pm 0.042$  kg,  $-0.135 \pm 0.032$  kg), but not between groups; and (b) systolic blood pressure for ADF-SM ( $-6 \pm 3$  mmHg,  $p = 0.04$ ), but non-significant ones for the ADF-L ( $-2 \pm 2$  mmHg) and ADF-D ( $-5 \pm 3$  mmHg) groups (Hoddy et al., 2014). Thus, it is interesting to note that different fasting windows may all still exhibit potential for physiological benefit, indicating some flexibility and individual variation.

Unfortunately, another recent long-term randomized trial on obese adults found no significant differences in adherence, body composition, or cardiovascular risk factors, when compared to daily caloric restriction (Trepanowski et al., 2017). This randomized control trial followed 100 obese adults from Chicago for 13 months, including a 1-month baseline, 6-month active weight loss, and 6-month weight maintenance phase, separating the participants into one of three groups: (1) ADF, with alternating 25% of EER on “fasting days” and 125% of EER on feasting days; (2) DER, with 75% of EER consumed every day; or (3) control group consuming habitual diet and physical activity levels (Trepanowski et al., 2017). At the 12-month mark, there were no significant improvements in either group relative to the control, e.g., weight loss ( $-6.0 \pm 2.5\%$  versus  $-5.3 \pm 2.3\%$ ) or HDL cholesterol ( $2.9 \pm 7.1\%$  versus  $1.9 \pm 7.0\%$ ), for ADF and DER,

respectively (Trepanowski et al., 2017). However, it is vital to consider the quality of the diet regarding these outcomes, insomuch as poor dietary choices can be independently inflammatory, thus superseding the potential benefits obtained by the fasting.

Time-restricted feeding is another method insomuch as rather than explicit caloric reduction, but the time window that is explicitly restricted, not dissimilar to Islamic-style Ramadan fasting, which may result in isocaloric or even hypercaloric intakes (Chaix et al., 2019). In resistance-trained males, this resulted in reductions of body fat, maintenance of free-fat mass and strength, but had adverse effects on the hormonal status of testosterone and insulin-like growth factor 1 (Moro et al., 2016). In this randomized control trial, 34 experienced resistance-trained Italian men were assigned to one of two groups: (1) a TRF with a 16-hour fasting window and 100% of EER consumed over three meals at 1 PM, 4 PM and 8 PM; or (2) a control group, that received 100% EER at 8 AM, 1 PM and 8 PM (Moro et al., 2016). After eight weeks, this resulted in: (a) significant decreases both within: ( $p = 0.0005$ ) and between groups ( $p = 0.0448$ ) for the TRF arm (-16.4%) versus the control (-2.8%); (b) similar non-significant maintenance of fat-free mass for TRF (0.86%) and control (0.64%); and (c) significantly decreased both within: ( $p = 0.0001$ ) and between ( $p = 0.0476$ ) groups for testosterone levels in the TRF participants (Moro et al., 2016). It is worth noting that despite the appearance of hormonal consequences, there were still significant benefits; however, this is something to be mindful of when considering the results in longer-term trials.

Moreover, in another trial, recreationally active males were able to increase muscular strength and endurance, while following a TRF protocol (Tinsley et al., 2017). This randomized control trial followed recreationally active men from Texas for eight

weeks, separated into one of two groups: (1) a TRF consisting of 3 days of resistance training with *ad libitum* dietary intake, paired with a 4-hour feeding window in the evenings of the remaining four non-training days per week; or (2) a normal diet allowing for *ad libitum* consumption every day, along with the three days of resistance training per week (Tinsley et al., 2017). While the results did not reach a significant difference within or between groups, there were modest differences in body fat and lean mass, as well as muscular strength and endurance, including: (a) slight improvements in body fat mass for the TRF (-0.2 kg,  $d = -0.07$ ) versus normal diet (0.8 kg,  $d = 0.018$ ); (b) slight declines in fat-free mass in the TRF (-0.2 kg,  $d = -0.02$ ) versus normal diet (2.3 kg,  $d = 0.25$ ); and (c) slight improvements in bench press repetitions (1 repetition,  $d = 0.39$ ) compared to a normal diet (-1 repetition,  $d = -0.33$ ), as a proxy for upper body endurance (Tinsley et al., 2017). These results are impressive inasmuch as they find that although there may be some absolute, total body mass loss, including both body fat and muscle, physical performance is not inherently compromised.

Similarly, in resistance-trained females, TRF was also able to produce similar muscular hypertrophy and performance gains, as well as fat mass loss, when compared to free eating women consuming a free eating control diet (Tinsley et al., 2019). In this randomized, placebo-controlled, double-blinded trial 40 generally healthy, active women from Texas were observed for eight weeks, assigned to one of three groups: (1) TRF, consisting of a daily 8-hour feeding window between 12 – 8 PM, with a placebo supplement, and three days of resistance training per week; (2) TRF<sub>HMB</sub>, consisting of the same protocol, but receiving 3 grams daily of  $\beta$ -hydroxy  $\beta$ -methylbutyrate (HMB); or (3) control, which consumed habitual diet and were also given the calcium lactate placebo

(Tinsley et al., 2019). This resulted in: (a) significant improvements ( $p = 0.03$ ) in body fat mass loss for the per-protocol TRF (-4%,  $d = -0.13$ ) and TRF<sub>HMB</sub> (-7%,  $d = -0.23$ ) groups, compared to the control (2%,  $d = 0.08$ ); (b) no significant difference in muscle gain for any of groups at ~2-3%; and (c) no significant differences in bench press repetitions, as a proxy for upper body muscular endurance (Tinsley et al., 2019).

While the type of body mass (BM) lost was not delineated, a recent TRF pilot trial in overweight, sedentary adult men and women, demonstrated improvements to body composition and walking speed (Anton et al., 2019). This single-arm pilot trial observed ten sedentary, overweight and obese elderly adults from Florida for four weeks and placed them all onto a TRF protocol, consisting of a 16 hour fast, with an 8-hour *ad libitum* feeding window, which resulted in significant ( $p = 0.009$ ) weight loss (-2.6 kg) by the end of the intervention (Anton et al., 2019). However, as this was a small pilot trial without a control group, the results do need further validation, but this does provide some evidence for safety and efficacy in older populations.

Another trial found TRF to reduce bodyweight and systolic blood pressure in obese individuals, in which total caloric intake decreased despite *ad libitum* allowances during the feeding windows (Gabel et al., 2018). This pilot trial followed 23 obese adults from Chicago for 12 weeks, put onto a TRF protocol allowing for unrestricted caloric intake within an 8-hour window, along with 16 hours of fasting, compared to a matched historical control group, based on previous research performed by the authors (Gabel et al., 2018). There were significant improvements for weight loss ( $-2.6 \pm 0.5\%$ ,  $p < 0.001$ ) and systolic blood pressure ( $-7 \pm 2$  mmHg,  $p = 0.02$ ), in the TRF group relative to the control (Gabel et al., 2018). However, the implications of the results of the trial suffer



from the limitation of the use of a historical control group, which warrants further exploration in randomized control trials.

A more recent model is referred to as “early” time-restricted feeding (eTRF), which focuses on aligning the eating to optimize metabolic activity with sleep-wake cycles, has found improvements to appetite regulation, blood pressure regulation, insulin sensitivity, and oxidative stress (Sutton et al., 2018; Kessler & Pivovarov-Ramich, 2019). It has also demonstrated an ability to improve circadian control of hormones (e.g., glucoregulation, lipid metabolism, and cortisol) and gene expression associated with autophagy and longevity, with consequent potential benefits for cardiometabolic health and aging (Patterson et al., 2015; Jamshed et al., 2019; Kessler & Pivovarov-Ramich, 2019). While it has been hypothesized that the benefits of eTRF may be mediated by increased energy expenditure, recent evidence has suggested that the primary mechanism is through a decrease in appetite, paired with increased fat oxidation (Ravussin et al., 2019). One trial compared different timing windows, i.e., eTRF versus “delayed” time-restricted feeding (dTRF), with both methods improving glycemic response, but only early day eating associated with lowering mean fasting blood glucose (Hutchinson et al., 2019).

Interestingly, some animal research has found negative consequences, notably increased abdominal and visceral fat gain, consequent to overfeeding and circadian disruption, following the fasts; however, these results (i.e., compensatory overconsumption) were not consistent in human research (Harvie & Howell, 2017). Regardless, these findings may prove useful in consideration of exclusively time-restricted fasts, as typified by Islamic-style Ramadan fasting (Venegas-Borsellino,

Sonikpreet, & Martindale, 2018). Other areas of concern are in pregnant and breastfeeding women, underweight individuals, as well as individuals with verified eating disorders (Malinowski et al., 2019). Diabetics represent another contentious area, principally due to hypoglycemia concerns and a relative lack of established data; however, the recent literature supports its implementation under carefully guided healthcare provider supervision (Horne, Muhlestein, & Anderson, 2015; Grajower & Horne, 2019).

While many find IF protocols to be easier to maintain, another common problem is assuring adherence to the diet, particularly in those with *a priori* assumptions, respecting the necessity of regular food consumption (Harvie & Howell, 2017; Potter et al., 2019). This fact is an area of particular note for the Orthodox Christian fasting prescriptions; as has been addressed, their primary purpose is not explicitly physical health or vanity, but rather a deeper meaning, which has potential implications for improving compliance. Additionally, although some are concerned about the ethical connotations of advocating for increased religiosity, the prospective benefits of both internal (e.g., psychological and behavioral) and external (e.g., social and transcendental) support factors, in ensuring compliance, cannot be ignored (Aldwin et al., 2014).

Beyond the somatic implications, as illustrated in Table 6, fasting may also result in changes to mood and cognition, e.g., increased mental alertness and sensation of calm, which again, from a purely materialist perspective, may represent an adaptive response to improve survivability during periods of famine (Fond et al., 2013; Anton et al., 2018). Preclinical data from animal models indicates that fasting exhibits antidepressant effects, likely mediated by increases in brain-derived neurotrophic factor (BDNF) signaling, as

well as improvements in serotonin and dopamine (Maswood et al., 2004; Roseberry, 2015; Shawky et al., 2015; Manchishi et al., 2018; Mattson et al., 2018). However, the evidence for the role of fasting in explicitly improving dopamine is more mixed (Shawky et al., 2015; Bastani, Rajabi, & Kianimarkani, 2017; Dunn et al., 2019).

While there is not much extant literature in humans to support it, a recent study on aging Malaysian men following a 5:2 Islamic diet found beneficial effects to vigor and mood, along with decreases in anger, tension, and confusion (Hussin et al., 2013). In this randomized control trial, 32 healthy older Malaysian Muslim men were followed for three months, separated into two groups: (1) fasting and calorie restriction (FCR) group, consisting of a daily energy reduction of 300-500 calories from their EER and twice a week time-restricted fasting during daylight hours; or (2) control group maintaining their habitual diet and lifestyle (Hussin et al., 2013). The FCR intervention resulted in significant reductions for: (a) confusion (-29.9% versus -1.4%,  $p = 0.039$ ); (b) total mood disturbance (-51.7% versus 7%,  $p = 0.029$ ); as well as physically for: (c) body fat losses (-5.7% versus 1.1%,  $p = 0.001$ ), when compared to the control group (Hussin et al., 2013).

An earlier study by the same research group, in a comparable population, also found improvements to body fat and quality of life during the Islamic FCR 5:2 diet protocol (Teng et al., 2011). This randomized control trial observed 25 healthy, aging adult Malaysian Muslim men for three months, assigned to either an FCR or control group (Teng et al., 2011). The FCR arm found significant improvements to: (a) body fat loss (-6.4% versus 2.7%,  $p = 0.003$ ); and (b) vitality (8.7% versus 5.9%,  $p < 0.05$ ),

compared to the control (Teng et al., 2011). These results help illustrate the potential for further physical and mental improvements of an intermittent fasting protocol.

Similarly, an observational trial on Iranian Muslim nurses found significant decreases in stress and depression and non-significant reductions in anxiety during the Ramadan period (Koushali et al. 2013). In this descriptive-analytical study, 313 Iranian Muslim nurses completed a Depression Anxiety Stress Scale (DASS<sub>21</sub>) questionnaire within 1-2 weeks before and after the Ramadan period (Koushali et al., 2013). Significant reductions were demonstrated for stress (-33%,  $p = 0.01$ ) and depression (-26.7%,  $p = 0.02$ ) scores, along with non-significant decreases in anxiety (-3.2%,  $p = 0.1$ ), when compared to baseline (Koushali et al., 2013). While promising, the lack of a control or comparator does limit the potential causal conclusions that can be derived from these results.

Another recent observational study examining Ramadan fasting in elderly Egyptian Muslims found improvements to anxiety, insomnia, and depression (Ghazi et al., 2018). This descriptive longitudinal study had 182 healthy, elderly Egyptian adults complete several health questionnaires in the week before and after fasting for Ramadan, including the General Health Questionnaire (GHQ-28) (Ghazi et al., 2018). Significant reductions in anxiety and insomnia (-54.3%,  $p = 0.001$ ) and depression (-36.1%,  $p = 0.002$ ) were found, following the conclusion of Ramadan (Ghazi et al., 2018). Unfortunately, as this was also an observational trial, the lack of a control limits potential causal conclusions, but does provide further theoretical grounding for the efficacy of fasting for mental health.

While examining young, female Iranian elite athletes, Ramadan fasting demonstrated improvements to cognitive performance, specifically reductions in the number of errors during a Stroop test (Ghayour Najafabadi et al., 2015). In this nonrandomized control trial, 17 elite Iranian female sprinters were observed during Ramadan for potential negative cognitive consequences, voluntarily assigned to either: (1) fasting observant, or (2) nonfasting groups (Ghayour Najafabadi et al., 2015). Fasting did not impair performance, but may improve cognitive functioning inasmuch as there was a significantly lower rate of task errors in the fasting group (-53.4%) both within-group and when compared to the nonfasting arm (-18.5%,  $p = 0.03$ ), post-Ramadan fasting (Ghayour Najafabadi et al., 2015). Although some of the improvements can be attributed to acclimation to the test, as there was even modest development in the nonfasting arm, it is worth noting that even in this small sample population, there was a significant difference in performance.

In one of the only trials investigating neurotransmitter and neurotrophin status during fasting in humans, another study on Ramadan fasters found increases to serotonin, BDNF and dopamine; however, similar to the results seen in animals, the dopamine levels despite increasing, did not reach significance (Bastani, Rajabi, & Kianimarkani, 2017). In this single-arm clinical trial, 29 healthy Iranian Muslim adults were examined for neurotransmitter and neurotrophin levels in response to Ramadan fasting (Bastani, Rajabi, & Kianimarkani, 2017). This resulted in: (a) significant increases in serotonin: (43.1%,  $p < 0.05$ ); (b) significant increases in BDNF (46.9%,  $p < 0.05$ ); and (c) non-significant increases in dopamine (7.5%,  $p > 0.05$ ); compared to their baseline numbers, two days prior to Ramadan (Bastani, Rajabi, & Kianimarkani, 2017).

A stimulating trial conducted on healthy enlisted adults examined the effects of a 48-hour nonnutritive diet on cognitive functioning, in a placebo-controlled fashion and found no significant differences, beyond satiety levels, in those who received food and those who did not (Lieberman et al., 2008). This double-blind, placebo-controlled crossover trial observed 27 healthy, young enlisted adults for 48 hours and separated them into one of three groups: (1) a 48-hour nonnutritive placebo hydrocolloid gel diet; (2) a taste-matched, carbohydrate-dense hydrocolloid gel diet; or (3) a taste-matched carbohydrate and fat-dense hydrocolloid gel diet (Lieberman et al., 2008). Statistically significant differences were found only in satiety levels ( $p < 0.001$ ,  $d = 0.196$ ), with all cognitive and mood effects, e.g., depression ( $p = 0.478$ ,  $d = 0.036$ ), not reaching significance (Lieberman et al., 2008). Beyond some topical similarity of the first week of Great Lent, including a 2-3 day dry fast, this study has little direct applicability for the model proposed in this thesis; however, it does provide some insight into the physiological and mental effects of short-term caloric deprivation.

Conversely, there are potential mood consequences, as demonstrated in a recent study examining otherwise healthy women (Watkins & Serpell, 2016). Using a self-referential, single TRF protocol, fasting increased irritability and depressive symptoms, but was paired with “positive psychological experiences,” e.g., the development of pride and reward; however, in terms of Orthodox Christian epistemology, this would also be considered an undesirable reaction (Watkins & Serpell, 2016). In this randomized crossover trial, 52 healthy adult women from London, were used as self-referential controls, completing a single 18-hour fast and another 18-hour nonfast (Watkins & Serpell, 2016). The results demonstrated significant differences ( $p < 0.01$ ) for irritability,

sense of achievement and sense of pride, in the fasting period, when compared to the non-fasting period (Watkins & Serpell, 2016).

Another recent trial also found nearly universal impairments to cognitive functioning and mood in healthy adults exposed to a 48-hour nonnutritive fast (Giles et al., 2019). In this randomized, double-blind, placebo-controlled crossover trial, 23 healthy enlisted adults underwent a 48-hour nonnutritive diet protocol, along with a 48-hour taste-matched, carbohydrate-dense hydrocolloid gel (Giles et al., 2019). When compared to their results in the fed state, significant cognitive and mood deficits, e.g., anger ( $p = 0.002$ ), depression ( $p = 0.001$ ), and confusion ( $p = 0.001$ ), were found while in the fasting state (Giles et al., 2019). However, just as in the earlier trial by this same research group of Lieberman et al. (2008), the direct applicability of these results is limited, as it was a substantially unrealistic construct but still provides a fascinating look into the potential downsides of fasting.

One more small trial with a sample of male amateur weightlifters found a single 48-hour fast to result in increased cognitive flexibility, as well as anger (Solianik et al., 2016). This single-arm clinical trial, nine healthy resistance-trained Lithuanian adult men subjected to a 48-hour zero-calorie intervention and tested for physiological and mental responses (Solianik et al., 2016). There were significant increases in anger ( $p = 0.039$ ,  $d = 1.09$ ) and cognitive flexibility, with the ability to switch between tasks also significantly improving ( $p = 0.004$ ,  $d = 0.98$ ), when compared to the baseline pre-fasting state (Solianik et al., 2016). While not a robust study, this trial helps to provide some preliminary evidence for the short-term effects of total energetic abstinence, with respect to physical and mental performance (Solianik et al., 2016). Thus, although mood may be

impacted, performance may improve, thus validating the results of Ghayour Najafabadi et al. (2015).

### **Hesychasm.**

While the current literature directly examining the empirical efficacy of *hesychastic* prayer is lacking, there has been some research which has demonstrated physical and psychological benefit (Rubinart, Moynihan, & Deus, 2016). A randomized control trial explored 88 Greek Orthodox Christian adults from throughout the United States for one month, assigned to either: (1) Jesus Prayer arm, consisting of instruction in the method and 10 minutes of daily at-home practice; or (2) control, instructed to maintain their standard prayer practice (Stavros, 1998). The author found statistically significant reductions in: (a) depression (0.78 to 0.43 versus 0.61 to 0.64,  $p < 0.01$ ); (b) anxiety (0.41 to 0.24 versus 0.40 to 0.42,  $p < 0.01$ ); (c) hostility (0.56 to 0.37 versus 0.58 to 0.53,  $p < 0.04$ ); (d) interpersonal sensitivity, i.e., inability to deal with conflict and stress with others (0.72 to 0.41 versus 0.62 to 0.60,  $p < 0.01$ ); (e) obsessive-compulsive symptoms (0.82 to 0.50 versus 0.64 to 0.77,  $p < 0.001$ ); and (f) somatic symptoms, e.g., pain and fatigue (0.40 to 0.29 versus 0.46 to 0.41,  $p < 0.02$ ), from baseline to completion, in the prayer group versus the control, respectively (Stavros, 1998).

In a single-arm case study, 15 Puerto Rican Orthodox Christians with a history of depression were investigated for six months, instructed on the methods of the Jesus Prayer, and assigned daily at-home practice (Di Leo, 2007). Statistically significant reductions in depression ( $23.1 \pm 4.32$  to  $7.5 \pm 2.45$ ,  $p < 0.001$ ) were demonstrated from the baseline until the end of the study, respectively (Di Leo, 2007).



Another single-arm case study followed 15 South African adults with a history of depression and anxiety for 12 weeks, completing a protocol consisting of daily practice of Jesus Prayer, along with Orthodox Christian fasting (Vujisic, 2009). There were statistically significant reductions in depression ( $23.9 \pm 4.18$  to  $13.1 \pm 4.89$ ,  $p = 0.002$ ) and anxiety ( $32.9 \pm 5.72$  to  $18.2 \pm 8.37$ ,  $p = 0.0129$ ), from baseline to completion, respectively (Vujisic, 2009).

One more single-arm case study examined 13 adult Californian Christians self-reported as chronic worriers for eight weeks, who were instructed in a providence-focused therapy for recurrent worriers (PFT-RW) protocol, which included the Jesus Prayer and daily at-home prayer sessions (Knabb, Frederick, & Cumming, 2017). The authors determined there to be statistically significant reductions to: (a) worrying ( $62.77 \pm 12.17$  to  $47.31 \pm 9.84$ ,  $p < 0.01$ ); (b) intolerance of uncertainty ( $79.15 \pm 18.83$  to  $59.31 \pm 19.00$ ,  $p < 0.01$ ); and (c) depression, anxiety and stress ( $25.85 \pm 14.61$  to  $12.15 \pm 7.08$ ,  $p < 0.01$ ), from baseline until the end of the study, respectively (Knabb, Frederick, & Cumming, 2017). This study consisted of three parts, including two larger preliminary sample sizes ( $n = 209$  and  $n = 99$ ); however, as the conclusions merely complemented the final phase and did not include direct measurements of depression, anxiety, and stress, further analysis and discussion was eliminated from this review.

In a case-control study, 30 Roman Catholic adults from California were investigated, assigned to two groups: (1) centering prayer intervention, instructed on the use of centering prayer, including the Jesus Prayer for ten weekly sessions of 2 hours; or (2) a non-intervention sample from the same church (Ferguson, Willemsen, & Castañeto, 2010). There were statistically significant within-group improvements for: (a)

collaborative style of coping with stress ( $27.60 \pm 9.94$  to  $26.87 \pm 10.52$ ,  $p < 0.001$  versus  $26.87 \pm 10.38$  to  $27.33 \pm 10.10$ ,  $p > 0.05$ ); and (b) anxiety ( $34.20 \pm 9.99$  to  $29.20 \pm 5.94$ ,  $p < 0.001$  versus  $35.53 \pm 7.49$  to  $32.80 \pm 7.02$ ,  $p < 0.001$ ), in the intervention group compared to the control group, from baseline to completion, respectively (Ferguson, Willemsen, & Castañeto, 2010). While the prayer group did exhibit significant statistically significant improvement over-time, it did not between-groups, as the control group experienced an unexpected reduction, as well. Moreover, the finding of an improvement in the collaborative style relationship of coping is associated with reductions in stress (Ferguson, Willemsen, & Castañeto, 2010).

A randomized control trial that followed 86 adult Californian Christians with daily stress for two weeks, assigned to either: (1) Jesus Prayer instruction, delivered through an online modality, along with 10 minutes of daily practice; or (2) control, consisting of a non-intervention waitlist (Knabb & Vasquez, 2018). There were statistically significant improvements to: (a) perceived stress ( $23.25 \pm 5.65$  to  $18.89 \pm 5.95$  versus  $22.76 \pm 7.22$  to  $21.98 \pm 5.94$ ,  $p = 0.007$ ); and (b) surrender style of coping with stress ( $42.93 \pm 7.23$  to  $46.55 \pm 6.91$  versus  $44.10 \pm 9.53$  to  $44.64 \pm 8.86$ ,  $p = 0.02$ ), in the prayer group versus the control, from baseline to completion of the study (Knabb & Vasquez, 2018). In the spiritual experience domain, there was statistically significant ( $p < 0.001$ ) within-group increases for the prayer arm, but not between-groups, when compared to the control group ( $63.41 \pm 10.95$  to  $68.61 \pm 11.01$  versus  $63.50 \pm 12.62$  to  $67.64 \pm 11.38$ ,  $p = 0.528$ ).

One final recent single-arm case study observed 10 non-conventional Roman Catholic adults for 2 months, along with a 5 month follow-up, who were instructed on the

use of the Jesus Prayer and given a recommendation to practice for 15-25 minutes at home, daily (Rubinart, Fornieles, & Deus, 2017). Statistically significant improvements were discovered for: (a) phobic anxiety ( $62.78 \pm 33.92$  to  $40.00 \pm 35.62$  to  $37.56 \pm 35.28$ ,  $p = 0.031$ ); and (b) interpersonal sensitivity ( $76.89 \pm 27.33$  to  $58.22 \pm 27.65$  to  $54.11 \pm 27.52$ ,  $p = 0.009$ ), from baseline to completion to follow-up, respectively (Rubinart, Fornieles, & Deus, 2017). The authors also found statistically significant reductions to: (a) tension ( $42.2 \pm 10.42$  to  $33.6 \pm 5.56$ ,  $p = 0.030$ ); and (b) fatigue ( $57.4 \pm 9.19$  to  $43.5 \pm 10.75$ ,  $p = 0.001$ ); as well as marginally significant reductions in: (c) depression ( $45.8 \pm 7.28$  to  $43.1 \pm 5.17$ ,  $p = 0.086$ ); and (d) anger ( $46.2 \pm 7.11$  to  $42.2 \pm 5.03$ ,  $p = 0.079$ ).

Using this protocol as a modern framework, conducting more clinical investigations can provide evidence of potential therapeutic applications. However, from a purely physiological perspective, the breathing practices may play a role in improving subclinical respiratory acidotic manifestations, with downstream effects in the development of chronic disease (Tyagi & Cohen, 2013; Pizzorno, 2015; Seifter & Chang, 2016). An additional alternative explanation is the increased stimulation of the vagal nerve, through breathing exercises, which may modulate the gut-brain axis, as well as inflammatory regulation (Russo, Santarelli, & O'Rourke, 2017; Breit et al., 2018; Bordoni et al., 2018; Gerritsen & Band, 2018).

### **Yoga.**

Yoga is an ancient Indian, more specifically Hindu, philosophy, of which there is an associated systematized method of techniques whose goal is the induction of mental tranquility or calmness, through the conscious control of breathing and thoughts (Telles and Singh, 2013; Kelly et al., 2018). From its introduction into the West, yoga has long

held onto its spiritual and metaphysical presuppositions, with a particularly syncretic affinity from academia, for other “consciousness-expanding” therapies (e.g., meditation and psychedelic drugs) (Richert & Decloedt, 2018; Nutt, 2019). As traditionally systematized in the Yoga Sutras, yoga consists of eight “limbs,” or steps, which include: *Yama* (self-control), *Niyama* (religious observance), *Asana* (postures), *Pranayama* (breathing exercises), *Pratyahara* (sensory control), *Dharana* (concentration), *Dhyana* (deep contemplation), and *Samadhi* (enlightenment) (Telles & Singh, 2013; Tyagi & Cohen, 2013; Sharma, 2016; Raveendran, Deshpandae, & Joshi, 2018). Of these, the third and fourth steps are what is generally considered “yoga” in the West, particularly concerning academia (Telles & Singh, 2013; Tyagi & Cohen, 2013; Sharma, 2016; Raveendran, Deshpandae, & Joshi, 2018). Upon superficial examination, there appears to be significant similarity in practice, particularly in the physical practices of *asana/pranayama* for yoga and *hesychasm* including: (1) necessity of daily ascetic practice, (2) sitting position, (3) control of breathing, (4) concentration towards inner calm, (5) repetition of a phrase, and (6) the turning inwards, with subsequent recognition of a transcendental “self” (Meyendorff, 1998 p. 59; Bakić-Hayden, 2008; Hisamatsu & Pattni, 2015; Papademetriou, 2015; Matko & Sedlmeier, 2019). However, the underlying metaphysics produce a significantly different *telos*, such that in yoga it is “realization” that the “self” is an illusion and that the individual is divine, whereas in the *hesychast* method it is an acknowledgment of the “self” being made in the image of God (Meyendorff, 1998 p. 59; Bakić-Hayden, 2008; Hisamatsu & Pattni, 2015; Papademetriou, 2015; Matko & Sedlmeier, 2019).

Having established that, from a purely physiological perspective, breathing based therapies, e.g., yoga have shown efficacy in mitigating the effects of psychological disturbances, through a variety of proposed mechanisms, including (a) improvements to the nervous system and neurotransmitter regulation, and (b) reductions to the allostatic load (Streeter et al., 2012; Sarris et al., 2019). Specifically, the basal ganglia appear to activate the dopaminergic system, whereas the lateral hypothalamus is stimulated, resulting in increased serotonergic activity (Kjaer et al., 2002; Mohandas, 2008). Subsequently, the actions of the hypothalamic-pituitary-adrenal (HPA) axis help with the downregulation of stress, mainly through reductions in corticotropin-releasing hormone and cortisol (Ross, & Thomas, 2010; Thirthalli et al., 2013; Tyagi & Cohen, 2013; Acevedo, Pospos, & Lavretsky, 2016; Chu et al., 2016; Raveendran, Deshpandae, & Joshi, 2018; Glannon, 2020).

An open-labeled active-control trial examined 54 depressed, non-suicidal Indian adults, for three months, allocated to one of three groups: (1) yoga practice daily for 1 hour; (2) non-yoga, control with standard of care using pharmaceutical drugs; or (3) active-control, consisting of both yoga and pharmaceutical drugs (Thirthalli et al., 2013). The participants exhibited: (a) significant reductions over time for depression ( $17.85 \pm 4.5$  versus  $5.3 \pm 5.0$ ,  $p = 0.001$ ); and (b) non-significant reductions to cortisol ( $109.9 \pm 63.8$  ng/mL versus  $97.99 \pm 48.25$  ng/mL,  $p = 0.08$ ); as compared to the baseline (Thirthalli et al., 2013). However, further analysis which separated by either: (1) all yoga participants; or (2) medication only, found significant reductions through yoga practice ( $111.9 \pm 58.4$  ng/mL versus  $91.7 \pm 47.3$  ng/mL,  $p = 0.006$ ) and non-significant increases in the medication group ( $95.7 \pm 61.1$  ng/mL versus  $113.0 \pm 48.5$  ng/mL,  $p = 0.34$ ), as

compared to baseline, respectively (Thirthalli et al., 2013). Thus, although not immediately apparent, yoga does appear to induce positive “anti-stress” effects through the modulation of cortisol release.

Regarding specific conditions, some benefits can be found in the literature for improving anxiety, depression, post-traumatic stress disorder (PTSD), attention-deficit hyperactivity disorder (ADHD), eating disorders, and overall quality of life (Rubia, 2009; Pascoe, Thompson, & Ski, 2017; Price et al., 2017; Domingues, 2018). Whereas serotonin plays a role in improving depression, the benefits to anxiety appear to be mediated by norepinephrine and dopamine regulation (Krishnakumar, Hamblin, & Lakshmanan, 2015).

A randomized control trial examined the effects of once-weekly yoga practice, in 44 Swedish adults with stress-related disorders, allocated to an active intervention or non-yoga control group for 12 weeks (Köhn et al., 2013). Significant improvements were found for: (a) stress reduction ( $15.5 \pm 7.5$ ,  $p = 0.000$ ), based on the Perceived Stress Scale (PSS); (b) anxiety reduction ( $3.2 \pm 2.4$ ,  $p = 0.019$ ), based on the Hospital Anxiety and Depression Scale (HADS); and (c) quality of life ( $-13.6 \pm 12.4$ ,  $p = 0.018$ ), based on the Euro Quality of Life-visual analog scale (EQ-VAS); in the yoga practitioners contrasted to the control arm (Köhn et al., 2013).

These results were replicated in a randomized, parallel-arm control trial that assessed 63 sedentary, Australian adults with stress-related disorders, for 16 weeks, assigned to either: (1) a yoga intervention, consisting of 3-5 days per week of 90-minute yoga practice; or (2) a control group, receiving no treatment (Hewett et al., 2018). The authors determined there to be significant improvements to: (a) stress reduction ( $20.7 \pm$

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4.7 to  $12.9 \pm 7.6$  versus  $21.3 \pm 5.4$  to  $19.1 \pm 6.6$ ,  $p < 0.003$ ); (b) general self-efficacy ( $29.5 \pm 4.4$  to  $32.6 \pm 4.1$  versus  $29.3 \pm 4.6$  to  $30.4 \pm 4.6$ ,  $p = 0.034$ ); (c) energy and fatigue ( $37.9 \pm 16.3$  to  $54.5 \pm 18.0$  versus  $37.9 \pm 19.8$  to  $43.5 \pm 15.9$ ,  $p = 0.019$ ); and (d) general health ( $50.5 \pm 18.9$  to  $65.5 \pm 20.9$  versus  $47.2 \pm 18.3$  to  $54.3 \pm 20.2$ ,  $p = 0.034$ ); in the yoga group compared to the control group, from baseline to completion, respectively (Hewett et al., 2018).

Similarly, another randomized control trial assigned 22 generally healthy adult male flood survivors, into either a yoga intervention or non-yoga control group, and followed them for one week to assess the effects on PTSD symptoms (Telles et al., 2010). The participants exhibited: (a) significant reductions in sadness in the yoga group ( $5.98 \pm 3.58$  mm versus  $7.12 \pm 3.21$  mm,  $p = 0.042$ ); (b) non-statistically significant decreases in anxiety in the yoga group ( $4.49 \pm 2.64$  mm versus  $5.72 \pm 3.19$  mm,  $p > 0.05$ ); and (c) significant increases in anxiety in the control group ( $4.88 \pm 3.15$  mm versus  $4.76 \pm 2.69$  mm,  $p = 0.046$ ); after the study, as compared to baseline, respectively, based upon a visual analog response scale (Telles et al., 2010).

Another randomized control pilot trial followed 27 depressed, non-suicidal adult women from Richmond, Virginia for eight weeks, assigned to either: (1) a yoga intervention, consisting of 75 minutes of yoga practice daily; or (2) a control group, consisting of 75 minutes weekly of “attention-control” health education (Kinser, Elswick & Kornstein, 2014). There were significant reductions in: (a) depression ( $14.9 \pm 1.3$  to  $4.8 \pm 1.4$  versus  $16.4 \pm 1.5$  to  $14.4 \pm 1.9$ ,  $p = 0.0017$ ); and (b) ruminations ( $27.4 \pm 1.6$  to  $20.6 \pm 1.7$  versus  $24.9 \pm 1.6$  to  $22.2 \pm 2.3$ ,  $p = 0.0172$ ); in the yoga group compared to the control, from the baseline to the conclusion of the study, respectively (Kinser, Elswick &

Kornstein, 2014). Subsequently, 9 participants were followed up with after one year, which found: (a) depression to slightly rebound in the yoga group ( $6.8 \pm 1.7$ ) and an elevation above baseline in the control arm ( $21.3 \pm 2.8$ ); and (b) ruminations remained approximately the same in the yoga arm ( $20.8 \pm 1.8$ ), whereas the control group once again rebounded ( $29.7 \pm 3.2$ ) above baseline (Kinser, Elswick & Kornstein, 2014). These results help illustrate that the benefits of the yoga may extend well beyond the intervention period if the individual makes associated lifestyle changes.

Further examination of the potential benefits of yoga for PTSD was conducted in a randomized control trial that assessed 64 women from Boston for ten weeks, assigned to either: (1) an active yoga arm that participated in a 1-hour yoga class, once-weekly; or (2) a control group that attended a 1-hour women's health education, class once-weekly (van der Kolk et al., 2014). Both yoga and the control significantly reduced: (a) PTSD symptoms ( $65.27 \pm 24.50$  to  $51.49 \pm 24.09$  versus  $73.06 \pm 25.86$  to  $63.75 \pm 28.81$ ,  $p < 0.0001$ ); and (b) depression ( $20.89 \pm 11.13$  to  $13.92 \pm 9.91$ ,  $p = 0.02$  versus  $24.06 \pm 11.47$  to  $19.47 \pm 11.91$ ,  $p = 0.001$ ); from baseline to completion, respectively (van der Kolk et al., 2014). While both groups demonstrated significant improvements to both PTSD and depression, the effect size was more extensive in the experimental arm ( $d = 1.07$ ) than the control group ( $d = 0.66$ ), thus indicating more improvement (van der Kolk et al., 2014).

Likewise, a randomized control pilot trial examined 80 adults with PTSD from Toronto for eight weeks, allocated to either: (1) a yoga intervention, consisting of a once-weekly 90-minute yoga class, paired with daily at-home practice for 15 minutes; or (2) a non-yoga waitlist (Jindani, Turner, & Khalsa, 2015). Statistically significant ( $p < 0.05$ ) improvements were determined for: (a) PTSD symptom reduction ( $59.5 \pm 9.3$  to  $41.8 \pm$



12.0 versus  $55.1 \pm 11.9$  to  $55.4 \pm 13.5$ ); (b) stress reduction ( $24.9 \pm 7.6$  to  $12.4 \pm 11.4$  versus  $24.8 \pm 7.2$  to  $21.6 \pm 4.8$ ); (c) anxiety reduction ( $9.4 \pm 5.2$  to  $5.7 \pm 4.3$  versus  $9.6 \pm 5.4$  to  $7.8 \pm 5.5$ ); and (d) resilience ( $112.4 \pm 24.1$  to  $124.7 \pm 23.2$  versus  $110.7 \pm 25.8$  to  $111.1 \pm 23.9$ ); in the yoga group as compared to the control group, from baseline to completion, respectively (Jindani, Turner, & Khalsa, 2015). Of particular note are the slight increases to PTSD symptomology and resilience in the control groups, as compared to the significant reductions for PTSD and improvements for resilience in the yoga group, thus further validating its therapeutic potential.

In a randomized, single-blind control trial, 81 Indian adult male coal miners with chronic obstructive pulmonary disease (COPD) were observed for 12 weeks, assigned to either: (1) the intervention of 90-minute daily yoga sessions, six days per week; or (2) the control, non-yoga waitlist, with both groups also receiving standard of care (Ranjita, Badhai, et al., 2016). Significant reductions ( $p < 0.0001$ ) were found through yoga practice, within and between groups for: (a) COPD assessment test ( $20.69 \pm 5.53$  to  $15.92 \pm 6.51$  versus  $21.81 \pm 5.48$  to  $22.36 \pm 5.65$ ); (b) depression ( $22.25 \pm 8.47$  to  $16.56 \pm 7.03$  versus  $24.14 \pm 9.21$  to  $23.36 \pm 5.65$ ); and (c) anxiety ( $80.67 \pm 16.06$  to  $68.86 \pm 17.96$  versus  $77.78 \pm 19.27$  to  $79.26 \pm 19.77$ ); as compared to the control arm, respectively (Ranjita, Badhai, et al., 2016).

Another randomized, single-blind control trial by the same authors, which followed the same sample, determined the yoga intervention to be efficacious at significantly reducing ( $p < 0.0001$ ): (a) dyspnea ( $5.08 \pm 1.40$  to  $3.84 \pm 1.75$  versus  $5.75 \pm 1.61$  to  $4.93 \pm 2.02$ ); and (b) fatigue ( $4.91 \pm 1.34$  to  $3.64 \pm 1.64$  versus  $4.78 \pm 1.69$  to  $4.51 \pm 1.68$ ); as well as significantly improving ( $p < 0.0001$ ) peripheral capillary oxygen

saturation ( $92.47 \pm 1.87$  to  $93.69 \pm 2.47$  versus  $92.36 \pm 1.58$  to  $92.58 \pm 1.71$ ); as compared to baseline and the control, respectively (Ranjita, Hankey, et al., 2016). Thus, in this population of respiratory-compromised individuals, yoga was demonstrated to be beneficial at improving both mental and physiological health.

Similarly, in a randomized, single-blind control-active comparator trial, 54 Iranian adult women with multiple sclerosis were followed for eight weeks, assigned to one of three groups: (1) yoga sessions for one hour, three times per week; (2) aquatic exercise for one hour, three times per week; or (3) control, non-exercise group; however, for brevity only the yoga and non-exercise groups will be highlighted (Razazian et al., 2016). This study demonstrated significant reductions ( $p < 0.05$ ) from the baseline, both within- and between-groups for (a) fatigue ( $38.94 \pm 13.63$  to  $16.22 \pm 9.60$  versus  $39.56 \pm 14.68$  to  $41.22 \pm 13.52$ ); and (b) depression ( $19.72 \pm 7.04$  to  $5.06 \pm 2.92$  versus  $20.78 \pm 6.22$  to  $21.33 \pm 6.88$ ); for the yoga group compared to the control group, respectively (Razazian et al., 2016).

In a fascinating and unique study design, 43 adults with COPD, from Burlington, Vermont, and Houston, Texas, were enrolled in a randomized, double-blind, control pilot study, assigned to either: (1) a *pranayama* intervention, consisting of twice-weekly meetings, with half yogic breathing practice, half educational material lessons, along with 30 minutes of daily at-home *pranayama* practice; or (2) a control group, consisting of twice-weekly meetings, with a dull hour of educational material lessons (Kaminsky et al., 2017). This study found: (a) 6-minute walk distance increases to the active group ( $28 \pm 33$  m) and decreases to the control ( $-15 \pm 32$  m), but the difference was only nearly significant ( $p = 0.06$ ); and (b) improvements in both groups to quality of life ( $31.0 \pm 16.7$

to  $23.1 \pm 9.9$ ,  $p < 0.05$ , versus  $36.7 \pm 21.4$  to  $34.8 \pm 21.5$ ,  $p > 0.05$ ), but only the *pranayama* group reached significance (Kaminsky et al., 2017).

A comparably-designed double-blind, randomized control trial examined 80 Iranian adults with anxiety related to an impending coronary angiography procedure (Mobini Bidgoli et al., 2016). Learning and implementing *pranayama* breathing exercises was found to be beneficial at significantly reducing anxiety, both within and between groups ( $53.37$  to  $40.75$  versus  $54.27$  to  $51.4$ ,  $p = 0.0001$ ), when compared with a control group receiving no breathing training, respectively (Mobini Bidgoli et al., 2016). This design is particularly informative, as by focusing explicitly on the *pranayama* breathing exercises, it provides a theoretical basis for the exploration of *hesychastic*-derived practices.

Other reported benefits are improvements to metabolism, sensory perception, and motor performance, as well as pain relief (Vallath, 2010; Telles & Singh, 2013). However, the benefits are not exclusively physiological, as there is evidence that it may improve self-regulation of food intake through greater awareness of choices and consumption, as well as decreases to speed of eating, often associated with excess stress (McIver, McGartland, & O'Halloran, 2009).

Another interesting finding is the potential for yoga to improve glycemic control and outcomes in individuals with diabetes and metabolic syndrome, likely through mitigating effects on the stress response, particularly, the HPA axis (Kiecolt-Glaser et al., 2012; Chu et al., 2016; Haider, Sharma, & Branscum, 2016; Raveendran, Deshpandae, & Joshi, 2018; Thind et al., 2018).

In an open-label, randomized, triple-arm feasibility study, 124 diabetic Indian adult women were assessed, assigned to one of 3 groups: (1) a yoga intervention, consisting of 1-hour yoga practice, twice per week; (2) an active comparator, consisting of a peer support intervention for 1 hour, once per week; or (3) a control group, receiving standard of care (Sreedevi et al., 2017). The participants exhibited changes to: (a) systolic blood pressure (-4.52%,  $p = 0.02$ ; 1.88%,  $p = 0.55$ ; 2.54%  $p = 0.34$ ); and (b) HbA<sub>1c</sub> (-2.08%,  $p = 0.39$ ; 5.37%,  $p = 0.15$ ; 2.13%,  $p = 0.50$ ); when compared to baseline levels, respectively (Sreedevi et al., 2017). Focusing on the yoga group, when compared to the control, only the systolic blood pressure reduction reached significance for the yoga group, but it elevated at the end for the control (Sreedevi et al., 2017). Additionally, whereas it did not reach statistical significance, HbA<sub>1c</sub> was trending downwards in the yoga arm and rising in the control group, which is something to be mindful of in future investigations (Sreedevi et al., 2017).

These results also indicate that yoga may demonstrate efficacy in improving cardiovascular disease risks, as well as rehabilitation from cardiovascular incidents (Raghuram et al., 2014; Chu et al., 2016; Amaravathi et al. 2018). In a systematic review and meta-analysis of 32 randomized control trials, comprising a total of 2,768 participants, yoga was found to induce statistically significant changes in various cardiometabolic biomarkers, including: (a) systolic blood pressure ( $-5.21 \pm 2.8$  mmHg,  $p = 0.0003$ ); (b) diastolic blood pressure ( $-4.98 \pm 2.19$  mmHg,  $p < 0.0001$ ); (c) total cholesterol ( $-18.48 \pm 10.68$  mg/dL,  $p = 0.0007$ ); (d) HDL cholesterol ( $3.20 \pm 1.34$  mg/dL,  $p < 0.0001$ ); (e) LDL cholesterol ( $-12.14 \pm 9.66$  mg/dL,  $p = 0.01$ ); (f) triglycerides ( $-25.89 \pm 10.29$  mg/dL,  $p < 0.0001$ ); (g) body mass index ( $-0.77 \pm 0.32$  kg/m<sup>2</sup>,  $p < 0.0001$ );

(h) bodyweight ( $-2.35 \pm 1.98$  kg,  $p = 0.02$ ); and (i) heart rate ( $-5.27 \pm 4.27$  beats/minute,  $p = 0.02$ ) (Chu et al., 2016). Non-significant reductions were also demonstrated for fasting blood sugar ( $-5.91 \pm 10.41$  mg/dL;  $p = 0.27$ ) and HbA<sub>1c</sub> ( $-0.06 \pm 0.18\%$ ,  $p = 0.74$ ) (Chu et al., 2016).

This was further validated by a single-blind, prospective randomized control trial that examined 250 adult Indian males, post-coronary artery surgery, assigned to either: (1) a yoga intervention, consisting of 30 minutes of daily yoga practice; or (2) an active-control, consisting of 30 minutes of daily breathing exercises, along with activity level matched physical therapy (Raghuram et al., 2014). Significant improvements were demonstrated for: (a) stress reduction ( $-14.94\%$ ,  $p = 0.001$ , versus  $6.7\%$ ,  $p = 0.49$ ); (b) depression ( $-30.77\%$ ,  $p = 0.001$ , versus  $-14.66\%$ ,  $p = 0.05$ ); (c) anxiety ( $-27.03\%$ ,  $p = 0.001$ , versus  $-13.02\%$ ,  $p = 0.003$ ); (d) triglycerides ( $-20.87\%$ ,  $p = 0.001$ , versus  $-17.02\%$ ,  $p = 0.001$ ); (e) HDL cholesterol in abnormal ( $< 35$  mg/dL) subset ( $25.68\%$ ,  $p = 0.001$ , versus  $21.68\%$ ,  $p = 0.03$ ); (f) LDL cholesterol in abnormal ( $\geq 100$  mg/dL) subset ( $-25.41\%$ ,  $p = 0.01$ , versus  $-9.18\%$ ,  $p = 0.27$ ); (g) VLDL cholesterol ( $-18.25\%$ ,  $p = 0.001$ , versus  $11.95\%$ ,  $p = 0.03$ ); (h) body mass index ( $-6.72\%$ ,  $p = 0.001$ , versus  $-1.15\%$ ,  $p = 0.09$ ); and (i) fasting blood sugar ( $-2.79\%$ ,  $p = 0.001$ , versus  $-2.41\%$ ,  $p = 0.27$ ); in the yoga group compared with the control group, respectively (Raghuram et al., 2014). While depression and anxiety decreased significantly in both arms, the results were greater in the yoga group. Additionally, the significant findings for blood sugar were not in line with the meta-analysis and represent a promising area for further exploration.

In a follow-up after 5 years with 300 participants, this same research group found significant psychological health improvements, including: (a) reduced stress ( $-17.96\%$

versus 12.13%,  $p = 0.011$ ); (b) increased mental health quality of life (3.2% versus -2.09%,  $p = 0.058$ ); and (c) reduced negative affect (-7.3% versus 30.70%,  $p = 0.05$ ); in the arm practicing yoga, as opposed to the control group receiving only the standard cardiac rehabilitation program, respectively (Amaravathi et al., 2018).

Similarly, in a randomized control trial, 154 Indian adults with coronary heart disease were examined for 6 months, and separated into either: (1) a yoga intervention, consisting of 35-40 minutes of daily yoga practice, 5 days per week; or (2) a non-yoga control group (Pal et al., 2011). There were significant improvements for: (a) systolic blood pressure reduction ( $11.02 \pm 9.46$  mmHg versus  $7.05 \pm 6.29$  mmHg,  $p < 0.002$ ); (b) diastolic blood pressure reduction ( $8.85 \pm 7.92$  mmHg versus  $6.01 \pm 4.98$  mmHg,  $p < 0.009$ ); (c) total cholesterol reduction ( $28.29 \pm 30.86$  mg/dL versus  $5.31 \pm 40.93$  mg/dL,  $p < 0.0001$ ); (d) HDL cholesterol increase ( $6.44 \pm 4.92$  mg/dL versus  $71.6 \pm 11.4$  mg/dL,  $p < 0.0001$ ); (e) LDL cholesterol reduction ( $15.10 \pm 45.23$  mg/dL versus  $1.09 \pm 39.64$  mg/dL,  $p < 0.04$ ); and (f) triglycerides reduction ( $38.04 \pm 37.39$  mg/dL versus  $7.33 \pm 34.82$  mg/dL,  $p < 0.0001$ ); in the yoga group contrasted with the control group, respectively (Pal et al., 2011).

A later randomized control trial, by the same research group, followed 258 Indian adults with coronary heart disease for 18 months, also assigned to an active yoga intervention and non-yoga control (Pal et al., 2013). The authors demonstrated significant reductions, both within- and between-groups, to: (a) systolic blood pressure ( $130.98 \pm 10.3$  mmHg to  $123.1 \pm 9.4$  mmHg versus  $129.8 \pm 14.1$  mmHg to  $129.1 \pm 9.3$  mmHg,  $p = 0.002$ ); (b) diastolic blood pressure ( $83.7 \pm 8.0$  mmHg to  $80.48 \pm 5.12$  mmHg versus  $82.3 \pm 8.6$  mmHg to  $83.8 \pm 5.7$  mmHg,  $p = 0.0002$ ); and (c) heart rate ( $73.0 \pm 9.1$

beats/minute to  $70.5 \pm 7.5$  beats/minute versus  $71.6 \pm 11.4$  beats/minute to  $73.3 \pm 8.7$  beats/minute,  $p = 0.0006$ ); from baseline to completion, in the yoga group as compared to the control group, respectively (Pal et al., 2013).

In one more prospective, single-blind randomized control trial, 80 Indian adults with coronary artery disease were observed for 3 months, and allocated to either: (1) a yoga intervention, with 1 hour of daily yoga practice, 6 days per week; or (2) a control group that only received pharmaceutical intervention (Yadav et al., 2015). Significant improvements were found for: (a) lung function, e.g. slow vital capacity ( $1.870 \pm 0.09$  L to  $2.185 \pm 0.102$  L versus  $1.453 \pm 0.08$  L to  $1.434 \pm 0.055$  L,  $p < 0.001$ ) and forced vital capacity ( $1.589 \pm 0.08$  L to  $2.122 \pm 0.115$  L versus  $1.587 \pm 0.102$  L to  $1.567 \pm 0.083$  L,  $p = 0.001$ ); and (b) cardiovascular function, e.g. systolic blood pressure ( $142.8 \pm 12.8$  mmHg to  $126.6 \pm 14.2$  mmHg versus  $142.6 \pm 4.6$  mmHg to  $132.63 \pm 6.4$  mmHg,  $p < 0.05$ ), diastolic blood pressure ( $84.4 \pm 10.2$  mmHg to  $80.00 \pm 8.4$  mmHg versus  $82.53 \pm 4.6$  mmHg to  $80.2 \pm 5.4$  mmHg,  $p < 0.05$ ), and heart rate ( $88.5 \pm 9.22$  beats/minute to  $76.2 \pm 8.51$  beats/minute versus  $87.8 \pm 8.54$  beats/minute to  $83.3 \pm 9.88$  beats/minute,  $p < 0.05$ ); in the yoga group compared to the control group, from baseline to conclusion, respectively (Yadav et al., 2015).

Closely associated is the role yoga may play in mediating inflammatory pathways, thus suggesting improvements to both recovery from chronic disease and reductions in pain: (Kiecolt-Glaser et al., 2012; Yadav et al., 2018; 2019; Djalilova et al, 2019). In a recent prospective, open-label, parallel-arm, randomized control trial, 260 Indian adults, with metabolic syndrome, were followed for 12 weeks, and allocated to either: (1) a yoga and diet lifestyle intervention, consisting of daily yoga practice for 90-minutes; or (2) an

active comparator group, consisting of only the dietary intervention (Yadav et al., 2018). There were significant improvements, in the yoga arm, to various inflammatory and oxidative stress biomarkers, including: (a) adiponectin: (6.95%,  $p = 0.004$  versus -9.81%,  $p = 0.617$ ); (b) leptin: (-17.37%,  $p = 0.001$  versus -2.49%,  $p = 0.068$ ); (c) interleukin-6 (-35.34%,  $p = 0.001$  versus -10.10%,  $p = 0.253$ ); (d) superoxide dismutase (2.21%,  $p = 0.011$  versus 1.57%,  $p = 0.251$ ); (e) thiobarbituric acid reactive substances (TBARS) (-30.66%,  $p < 0.001$  versus 10.98%,  $p = 0.683$ ); and (f) 8-hydroxy-2'-deoxyguanosine (8-OhdG) (-7.00%,  $p = 0.015$  versus 1.30%,  $p = 0.798$ ); as compared to the diet-only intervention, respectively (Yadav et al., 2018). The authors also found statistically significant between-group changes for bodyweight (-2.89% versus -1.88%,  $p = 0.043$ ) and waist circumference (-3.05% versus -1.59%,  $p = 0.001$ ), in favor of the yoga group, despite both groups achieving in-group significance ( $p < 0.001$ ) at the completion of the study (Yadav et al., 2018).

Comparably, in *hesychastic* practice, the combined practice of prolonged standing and prostrations are associated with the activation of the endorphin release and analgesia (Bradford, 2011). Interestingly, however, recent research has indicated that despite some evidence of endorphin release, that the opioid system is insufficient to fully explain the pain relief benefits of prayer. Thus, from the purely physiological perspective, it has been postulated that the endocannabinoid and dopaminergic systems likely play a more prominent role (Elmholdt et al., 2017). Collectively, these results provide an evidentiary basis for the utilization of psychosomatic breathing and exercises in the mitigation of diseases of civilization.

### **Meditation.**



Meditation and other mindfulness exercises have demonstrated an ability to improve relaxation response, with subsequent benefits to modulation of chromosomal (e.g., telomere length) and inflammatory processes, which has implications for metabolic syndrome and longevity (Esch, Kream, & Stefano, 2018; Basso et al., 2019; Keng et al., 2019).

A randomized control trial followed 68 black adults with metabolic syndrome from Atlanta, Georgia, for 12 months (Vaccarino et al., 2013). The participants were allocated to either: (1) a meditation intervention consisting of 21 instructional sessions of consciously resting meditation for 1-1.5 hours per session, along with 20 minutes of practice, twice daily; or (2) a control group who received health education classes and a similar recommendation to focus on applying the lessons learned for 20 minutes, twice daily (Vaccarino et al., 2013). There were significant improvements in the meditation arm when compared to the control group, for: (a) triglycerides ( $-14.35 \pm 17.4$  mg/dL versus  $17.72 \pm 17.91$  mg/dL,  $p = 0.012$ ); and (b) metabolic syndrome score ( $-0.41 \pm 0.48$  versus  $0.25 \pm 0.47$ ,  $p = 0.049$ ), respectively (Vaccarino et al., 2013).

In another randomized control trial, 60 adults with coronary artery disease from New Delhi, India were examined for 6 months, and assigned to either: (1) a meditation group, consisting of at least 5 days per week of concentrative meditation practice; or (2) a non-meditative waitlist control group (Sinha et al., 2018). Statistically significant improvements were demonstrated for: (a) fasting blood glucose ( $97.2 \pm 11.0$  mg/dL to  $91.9 \pm 5.5$  mg/dL,  $p = 0.002$  versus  $95.4 \pm 11.1$  mg/dL to  $93.3 \pm 7.8$  mg/dL,  $p = 0.093$ ); and (b) hemoglobin A<sub>1c</sub> ( $5.8 \pm 0.9$  to  $5.6 \pm 0.7$ ,  $p = 0.023$  versus  $5.8 \pm 1.1$  to  $5.7 \pm 0.8$ ,  $p = 0.295$ ), in the meditation group as compared to the control group, from baseline to

completion, respectively (Sinha et al., 2018). The authors also found statistically significant increases ( $83.4 \pm 18.3$  pmol/L to  $88.2 \pm 16.0$ ,  $p = 0.015$ ) in fasting serum insulin levels for the control group, compared to nonsignificant increases ( $77.3 \pm 20.2$  to  $80.8 \pm 18.3$ ,  $p = 0.095$ ) in the meditation arm.

One more recent randomized control trial followed 48 adults with hypertension and/or T2DM from Seoul, South Korea for eight weeks assigned to either: (1) a meditation intervention consisting of twice-weekly brain-education meditation class; or (b) a matched control group given health education classes (Lee et al., 2019). There were statistically significant reductions over time to LDL cholesterol in the meditation group ( $104.49 \pm 32.73$  mg/dL to  $90.67 \pm 35.54$  mg/dL,  $p = 0.04$ ), as opposed to highly significant increases ( $86.57 \pm 35.82$  mg/dL to  $97.36 \pm 38.14$  mg/dL,  $p < 0.0001$ ) in the control group (Lee et al., 2019).

Additionally, through its potential for stress relief, meditation has demonstrated benefits in reducing hypertension (Jindal, Gupta, & Das, 2013; Meng et al., 2018; Basso et al., 2019). An older randomized control trial examined 103 adults with coronary heart disease from Southern California for 16 weeks (Sinha et al., 2018). They were assigned to either: (1) a meditation intervention, which paired at daily at-home practice, with weekly 1.5-hour transcendental meditation classes; or (2) a matched control group which took health education classes and were to apply the lessons to recommendations at-home (Sinha et al., 2018). Statistically significant improvements were found for: (a) systolic blood pressure ( $126.4 \pm 14.4$  mmHg to  $123.5 \pm 14.9$  mmHg versus  $127.4 \pm 15.5$  mmHg to  $130.5 \pm 16.1$  mmHg,  $p = 0.03$ ); (b) mean arterial blood pressure ( $90.3 \pm 9.1$  to  $90.1 \pm 9.0$  mmHg versus  $91.7 \pm 9.5$  to  $94.5 \pm 10.9$  mmHg,  $p = 0.03$ ); and (c) insulin resistance (-

$0.79 \pm 2.04$  versus  $0.60 \pm 2.85$ ,  $p = 0.03$ ), in the meditation group as compared to the control group, from baseline to completion, respectively (Sinha et al., 2018). The authors also found nearly significant ( $p = 0.07$ ) changes in the high-frequency power dimension of heart rate variability for the meditation group ( $0.10 \pm 0.17$ ) versus the control group ( $-0.50 \pm 0.17$ ).

Another randomized control trial followed generally healthy, adult college students from Washington, D.C. for three months, allocated to either: (1) a transcendental meditation group, which practiced for 20 minutes, twice daily; or (2) a non-meditation waitlist control arm (Nidich et al., 2009). Nonsignificant improvements were demonstrated to: (a) systolic blood pressure ( $-2.0 \pm 1.2$  mmHg versus  $0.4 \pm 1.1$  mmHg,  $p = 0.15$ ); and (b) diastolic blood pressure ( $-1.2 \pm 0.9$  mmHg versus  $0.5 \pm 0.8$  mmHg,  $p = 0.15$ ); however, in a subgroup at-risk for hypertension, these results reached statistical significance, with: (c) systolic blood pressure ( $-5.0 \pm 1.9$  mmHg versus  $1.3 \pm 1.7$  mmHg,  $p = 0.014$ ); and (d) diastolic blood pressure ( $-2.8 \pm 1.4$  mmHg versus  $1.2 \pm 1.2$  mmHg,  $p = 0.028$ ), in the meditation arm compared to the control group, from baseline to completion, respectively (Nidich et al., 2009). These authors also found the meditative practice to result in statistically significant reductions to: (a) psychological distress ( $-18.9 \pm 3.2$  versus  $-6.1 \pm 2.9$ ,  $p = 0.004$ ); (b) anxiety ( $-3.7 \pm 0.7$  versus  $-1.0 \pm 0.6$ ,  $p = 0.003$ ); and (c) depression ( $-5.2 \pm 1.0$  versus  $-1.9 \pm 0.6$ ,  $p = 0.012$ ). Expanding on the mental health end, the implementation of mantras, i.e., repeated spiritual words or phrases, from various religious traditions, has demonstrated mixed efficacy, but may be associated with reductions in anxiety and depression, as well as improved quality of life (Cummings & Pargament, 2010; Goyal et al., 2014; Matko & Sedlmeier, 2019).

A randomized control trial examined 90 generally healthy, adult college students from Durham, North Carolina for four weeks, assigned to either: (1) a meditation arm, which paired weekly 75 minute Koru meditation classes, with at least ten minutes of daily at-home practice; or (2) a non-meditation waitlist control arm (Greeson et al., 2014). The authors determined there to be statistically significant improvements for: (a) stress (3.62 versus 0.71,  $p = 0.037$ ); (b) sleep quality (3.04 versus 0.03,  $p = 0.033$ ); (c) mindfulness (-6.60 versus 0.59,  $p < 0.001$ ); and (d) self-compassion (-0.20 versus -6.38,  $p < 0.001$ ), in the meditation group, as compared to the control group, respectively (Greeson et al., 2014).

In a recent randomized control trial, 42 generally healthy adults with no meditation experience from New York were followed for eight weeks, assigned to groups that listened daily to 13 minutes of (1) guided meditation, or (2) a Radio Lab podcast, which focuses on educating the general public on science and philosophy (Basso et al., 2019). There were statistically significant improvements to: (a) mood ( $33.333 \pm 5.795$  to  $19.095 \pm 8.719$ ,  $p = 0.032$  versus  $23.238 \pm 6.530$  to  $22.190 \pm 6.169$ ,  $p = 0.651$ ); and (b) fatigue ( $32.714 \pm 2.468$  to  $28.810 \pm 2.640$ ,  $p = 0.013$  versus  $29.619 \pm 2.996$  to  $30.714 \pm 3.022$ ,  $p = 0.072$ ), in the meditators, when compared to the control group, after the study, respectively (Basso et al., 2019). The authors also found nonsignificant decreases ( $p = 0.118$ ) to anxiety in the meditation group ( $11.238 \pm 1.906$  to  $8.619 \pm 2.028$ ), paired with nonsignificant increases ( $p = 0.172$ ) for the control group ( $9.429 \pm 1.788$  to  $12.048 \pm 2.128$ ) (Basso et al., 2019).

However, in the context of transcendental meditation, these mantras were determined to have some efficacy at ameliorating the effects of PTSD in war veterans

(Krishnakumar, Hamblin, & Lakshmanan, 2015). In a randomized control trial, 173 adult war veterans with PTSD from California and Massachusetts were examined for eight weeks, with an 8-week follow-up, assigned to either: (1) a meditation group, consisting of weekly 1-hour mantram repetition sessions; or (2) a control arm, which engaged in weekly 1-hour present-centered psychotherapy sessions (Bormann et al., 2018). There were statistically significant improvements to PTSD as measured by (a) the Clinician-Administered PTSD Scale (CAPS) score ( $-9.98 \pm 6.02$ ,  $p = 0.006$  and  $-9.34 \pm 7.84$ ,  $p = 0.04$ ); and (b) the PTSD Checklist – Military (PCL-M) score ( $-5.83 \pm 4.10$ ,  $p = 0.04$  and  $-4.51 \pm 5.21$ ,  $p = 0.25$ ), as a between-groups difference from baseline to study completion and at the follow-up, respectively (Bormann et al., 2018). The authors also demonstrated statistically significant reductions in insomnia ( $-4.13 \pm 1.94$ ,  $p = 0.002$  and  $-4.81 \pm 2.51$ ,  $p = 0.004$ ).

Similar to yoga, meditation appears to influence HPA axis regulation, with consequent increases in serotonin and dopamine, and decreases to corticotrophin-releasing hormone (Rubia, 2009; Jindal, Gupta, & Das, 2013). However, it may also be able to improve nitric oxide levels, which provides further potential mechanisms for its mood and cardiovascular benefits (Rubia, 2009; Jindal, Gupta, & Das, 2013).

Additional potential mental health benefits associated with meditation and mantras include recovery from alcohol and drug abuse, cognitive and memory improvements, and improved academic performance (Buchler et al., 2011; Burke et al., 2017). A recent trial with Buddhists, examining the efficacy of mantras concerning neurophysiological responses to positive, negative, and neutral stimuli, found benefits to emotional and cognitive processing in the later stages, after the initial fear response (Gao

et al. 2016). Whereas another trial, which utilized brain imaging, found meditation to protect both white matter and the hippocampus from degeneration, likely through the modulation of the deleterious effects of stress (Kurth, Cherbuin, & Luders, 2015; Laneri et al., 2015).

From the Buddhist perspective, both the self and suffering are illusions, i.e., *Maya*, brought about by a focus on the material world; as such, the mantras are designed to bring about more “noble thoughts,” which encourage of state of detachment (Diller & Lattal, 2008; Avasthi, Grover, & Kate, 2013; Goyal et al., 2014; Papademetriou, 2015; Yaden et al., 2017; Meng et al., 2018). Moreover, it is believed that “beneath” the various layers of relative truth, the underlying “ultimate truth,” or *Parramatta-Sacca*, represented by the motionless, silence, and emptiness; similarly, in Taoism, this concept is expressed as emptiness or *Wu* (Damascene, 2012, pp. 268-269; Pyle, 2012). This “emptiness” is associated with a loss of will and emotional disinterest, as physiologically mediated by increased dopamine release, which may have prospective therapeutic value in combatting addictive behaviors (Kjaer et al., 2002; Garland et al., 2017). Unfortunately, while there is potential for physiological and psychological benefit, the focus on this *Maya*, leads to the logical conclusion of meaninglessness and thus does not provide adequate *telos*.

In contrast to the usage of a meaningless mantra, the Orthodox utilize a formulaic prayer with the express purpose of focusing one’s remembrance on the *Logos* (Meyendorff, 1998 pp. 62-63; Bradford, 2011; Damascene, 2012, p. 355; Ware, 2014, pp. 32-33). Thus, on a fundamental level, rather than an attempt to liberate oneself from suffering through understanding and simple acceptance of the inherent suffering,

Orthodox attempt to overcome suffering through the contemplation of the uncreated *logoi*, in pursuit of knowledge of the *Logos* (Hamalis, 2013; Martin, 2015). As such, beyond merely “emptying the mind,” the Orthodox attempt to subsequently fill themselves back up with the *Logos*, through the *nous* (Damascene, 2012, pp. 386-387).

Additionally, whereas the goal of Buddhist meditation is the achievement of a state of mindfulness, as addressed in the *hesychasm* section, the explicit purpose is watchfulness; whereby the principal distinction is the degree to which it is an individual action, versus participation of uncreated energies (Meyendorff, 1998 p. 119; Hamalis, 2013; Martin, 2015, Nicolaidis et al., 2016; Matko & Sedlmeier, 2019). The statements of St. Mark the Ascetic supplement this, in that “the *Logos* became man, so that man might become *Logos*” (Smith, 2012, pp. 190-191).

Thus, rather than a Buddhist-style overt rejection of the ontological reality of the “self,” the Orthodox perspective explicitly endorses the existence of the self, with fundamental reality encompassed in the Person of the *Logos*. As illustrated by St. Thalassios the Libyan, “the forceful practice of self-control and love, patience and stillness, will destroy the passions hidden within us,” i.e., despite the illusory presentation of sensory distractions which impair well-being, the self exists, and through the synergistic efforts of both individual choice and the surrender to the transcendental, one can overcome these passions (Lazarou & Matalas, 2010; Smith, 2012, pp. 172-173).

### **Mindfulness-Based Stress Reduction (MBSR).**

There are various permutations of psychotherapy developed as a means of addressing man’s inner existence, whereby in essence (s)he fulfills the role of a therapist that was historically occupied by shamans and priests (Vlachos, 2010, pp. 66-67).

However, the language of “mental” health and “well-being” has replaced the spiritual dimensions (Ho & Ho, 2007; Young, 2011). From a purely secular perspective, both complementary and alternative therapies, as well as modern psychology and neuroscience research, have integrated mindfulness-based interventions (Yaden et al., 2017; Sarris et al., 2019). Similar to those from a more explicitly Buddhist framework, these modalities seek to achieve a state of mindfulness, ostensibly without the metaphysical presuppositions (Laner et al., 2015; Murphy, 2016; Esch, Kream, & Stefano, 2018; Shapero et al., 2018; Montero-Marin et al., 2019). Unfortunately, the devotional aspects of meditative practices appear to offer greater explanatory power than a simple reductionistic, procedural approach (Murphy, 2016; Montero-Marin et al., 2019).

Moreover, it is not entirely accurate to describe these methods as truly “secular” as dogmatic concepts such as the “lack of self” and “impermanence” are often maintained in mindfulness therapies; consistent with its roots in the far-eastern traditions, “mindfulness” is usually defined as a “way of being” (Knabb, 2012; Kenne Sarenmalm et al., 2017). However, even if stripped of these underpinnings, despite potential feelings of relief, secular mindfulness lacks the appropriate mechanisms to adequately change thoughts and behaviors (Brewer, Davis & Goldstein, 2013; Martin, 2015; Murphy, 2016; Shapero et al., 2018). As such, there has been a recent reconsideration of returning to increased R/S in practice (Koenig, 2012; Manickam, 2013; Montero-Marin, 2019).

As has been argued earlier, a lack of *telos*, i.e., life purpose or meaning, is a primary mediator in the incidence of modern diseases of civilization. A relatively recent randomized control trial followed 139 Canadian adults with irritable bowel syndrome for six months, separated into two groups: (1) MBSR for eight weeks, consisting of 1.5 hour



weekly sessions, along with 45 minutes of daily at-home practice; or (2) a control group, receiving treatment as usual, on a non-intervention waitlist (Zernicke et al., 2013). The authors found statistically significant improvements to: (a) sense of purpose ( $27.5 \pm 8.5$  to  $30.5 \pm 10.5$  versus  $25.9 \pm 8.9$  to  $26.8 \pm 9.6$ ,  $p = 0.009$ ); (b) symptom severity ( $248.6 \pm 108.9$  to  $169.4 \pm 125.9$  versus  $249.0 \pm 107.6$  to  $213.8 \pm 119.3$ ,  $p = 0.02$ ); (c) quality of life ( $65.3 \pm 23.6$  to  $75.0 \pm 24.9$  versus  $61.6 \pm 23.3$  to  $63.1 \pm 23.3$ ,  $p = 0.02$ ); (d) stress ( $76.7 \pm 34.8$  to  $52.2 \pm 40.7$  versus  $81.7 \pm 34.3$  to  $75.7 \pm 37.7$ ,  $p < 0.001$ ); and (e) mood disturbance ( $48.6 \pm 36.7$  to  $28.5 \pm 45.9$  versus  $50.1 \pm 36.3$  to  $37.4 \pm 41.8$ ,  $p < 0.001$ ), in the intervention group as compared to the control group, from baseline until follow-up, respectively (Zernicke et al., 2013).

In another randomized control trial, 104 adult women with fibromyalgia from Spain were examined for 6 months, allocated to either: (1) 20 weekly MBSR sessions for 2 hours, with 20 minutes of daily at-home practice; or (2) a control group, which received treatment as usual (Cejudo et al., 2019). Statistically significant improvements were determined for: (a) satisfaction with life ( $23.72 \pm 5.72$  to  $24.98 \pm 5.62$  versus  $23.81 \pm 5.85$  to  $23.82 \pm 5.96$ ,  $p = 0.041$ ); (b) positive affect ( $21.32 \pm 5.04$  to  $23.73 \pm 4.92$  versus  $21.03 \pm 5.24$  to  $21.12 \pm 5.61$ ,  $p = 0.026$ ); (c) mental health ( $15.48 \pm 5.29$  to  $16.92 \pm 3.70$  versus  $16.01 \pm 3.22$  to  $15.39 \pm 4.95$ ,  $p = 0.028$ ); and (d) resilience to stress ( $38.53 \pm 7.12$  to  $41.98 \pm 6.96$  versus  $39.04 \pm 7.01$  to  $38.92 \pm 6.84$ ,  $p = 0.012$ ), in the MBSR arm compared to the control group, from baseline to completion, respectively (Cejudo et al., 2019).

One more randomized control trial investigated 166 adult Swedish women who survived breast cancer for 3 months, assigned to one of three groups: (1) MBSR,

consisting of 8 weekly sessions, paired with 20 minutes at-home practice, 6 days per week; (2) a control group, receiving only treatment as usual, with no MBSR training; or (3) an active-control group, which received the same 20-minute at-home practice as the primary intervention group, without the weekly in-person sessions (Kenne Sarenmalm et al., 2017). There were statistically significant benefits to: (a) depression ( $4.3 \pm 3.7$  to  $3.3 \pm 3.3$  versus  $3.5 \pm 3.5$  to  $3.8 \pm 3.8$ ,  $p = 0.015$ ); (b) psychological symptoms ( $1.4 \pm 0.8$  to  $1.2 \pm 0.9$  versus  $0.9 \pm 0.8$  to  $0.9 \pm 0.8$ ,  $p = 0.019$ ); (c) global distress ( $1.9 \pm 0.6$  to  $1.8 \pm 0.6$  versus  $1.6 \pm 0.8$  to  $1.7 \pm 0.9$ ,  $p = 0.013$ ); (d) mental health ( $67.9 \pm 19.0$  to  $74.1 \pm 17.1$  versus  $76.2 \pm 20.0$  to  $74.4 \pm 20.7$ ,  $p = 0.001$ ); and (e) coping capacity, i.e., sense of coherence ( $65.7 \pm 13.7$  to  $67.7 \pm 12.0$  versus  $71.4 \pm 11.1$  to  $69.3 \pm 11.5$ ,  $p = 0.028$ ), from baseline to study conclusion, in the MBSR intervention compared to the non-MBSR control group, respectively (Kenne Sarenmalm et al., 2017).

As the authors did not directly compare the intervention to the active-control groups, the latter was generally excluded from this review, except for one factor of interest: personal post-traumatic growth, i.e., a measure of life appreciation. Although the MBSR intervention found significant within-group improvement ( $59.78 \pm 19.5$  to  $64.5 \pm 17.7$ ,  $p = 0.005$ ), compared to the control group which was not significant ( $p > 0.05$ ) (Kenne Sarenmalm et al., 2017). However, the active-control arm did exhibit statistically significant increases in post-traumatic growth, compared to the non-MBSR control ( $55.92 \pm 2.7$  to  $57.13 \pm 17.6$  versus  $52.58 \pm 19.2$  to  $51.57 \pm 20.8$ ,  $p = 0.049$ ) (Kenne Sarenmalm et al., 2017).

One final exciting finding from Kenne Sarenmalm et al. (2017) was in statistically significant improvements to natural killer cells from the MBSR intervention, when

contrasted with the non-MBSR control group ( $0.24 \pm 0.16$  to  $0.22 \pm 0.10$  versus  $0.20 \pm 0.11$  to  $0.22 \pm 0.13$ ,  $p = 0.041$ ). The authors noted a significant relationship between distress and impairments to immunological function. This relationship was corroborated by a randomized control trial that examined 154 generally healthy adults from Wisconsin, who had a recent history of acute respiratory illness (ARI), for eight weeks, assigned to one of three groups: (1) MBSR, consisting of 8 weekly sessions for 2.5 hours, paired with 45 minutes of daily at-home practice; (2) control, receiving only clinical observation; or (3) exercise, consisting of 8 weekly moderate-intensity exercise sessions for 2.5 hours, paired with 45 minutes of daily at-home exercise (Barrett et al., 2012). Significant reductions were demonstrated in: (a) ARI incidence ( $0.14 \pm 0.18\%$ ,  $p = 0.083$  versus  $0.19 \pm 0.18$ ,  $p = 0.032$ ); (b) ARI illness length ( $3.85 \pm 4.14$  days,  $p = 0.034$  versus  $3.76 \pm 4.00$  days,  $p = 0.032$ ); and (c) ARI global severity ( $214 \pm 158$ ,  $p = 0.0042$  versus  $110 \pm 215$ ,  $p = 0.16$ ), as a between-groups difference, compared to the control, in the MBSR and exercise groups, respectively (Barrett et al., 2012). It is pertinent to note that while the MBSR group only trended towards, but did not reach, statistical significance ( $p = 0.083$ ), there was a significant benefit ( $p = 0.0042$ ) exhibited in symptom severity, while the exercise group did not reach significance for severity ( $p = 0.16$ ) (Barrett et al., 2012).

In a more recent randomized control trial by the same research group, 413 generally healthy adults from Wisconsin, with a recent history of ARI, were followed for eight weeks, allocated to one of three groups: (1) MBSR, consisting of eight weekly sessions for 2.5 hours, paired with 45 minutes of daily at-home practice; (2) control, receiving only clinical observation; or (3) exercise, consisting of eight weekly moderate-intensity exercise sessions for 2.5 hours, paired with 45 minutes of daily at-home exercise

(Barrett et al., 2018). There were reductions to: (a) ARI incidence ( $0.16 \pm 0.23\%$ ,  $p = 0.17$  versus  $0.10 \pm 0.23$ ,  $p = 0.42$ ); (b) ARI global severity ( $70 \pm 116$ ,  $p = 0.65$  versus  $102 \pm 106$ ,  $p = 0.21$ ); and (c) ARI illness length ( $1.2 \pm 2.8$  days,  $p = 0.65$  versus  $1.4 \pm 2.6$  days,  $p = 0.33$ ), as a between-groups difference, compared to the control group, in the MBSR and exercise groups, respectively (Barrett et al., 2018). While these results did not reach statistical significance, subsequent analysis utilizing a multivariate zero-inflated regression model found MBSR to induce improvements to incidence ( $p = 0.036$ ) and global severity ( $p = 0.042$ ).

Unfortunately, although there is potential, the literature exhibits high heterogeneity concerning the efficacy of mindfulness for improving immunoregulation (Schakel et al., 2019). Despite these limitations, as seen in the previous methods, MBSR has been associated with reductions in chronic pain, anxiety, depression, and gastrointestinal disorders, likely through modulation of the gut-brain axis, by way of vagal nerve stimulation (Rod, 2015; Murphy, 2016; Breit et al., 2018; Steer, 2019). Moreover, these benefits are as efficacious as, although not necessarily superior to, pharmaceutical interventions in the management of depression (Segal et al., 2010; Young, 2011; Kuyken et al., 2015; 2019).

A randomized control trial analyzed 160 Canadian adults with major depressive disorder that were in remission and were on antidepressants for 18 months, assigned to one of three groups: (1) MBSR, consisting of 8 weekly sessions for 2 hours; (2) control, receiving maintenance anti-depressants; or (3) placebo treatment with clinical management (Segal et al., 2010). The authors found improvements in the hazard ratios for depression relapse of 0.26 (0.09-0.79, 95% confidence interval) and 0.24 (0.07-0.89,

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95% confidence interval) for the MBSR and control arms, respectively (Segal et al., 2010). When compared against each other, a hazard ratio of 1.07 (0.25-4.49, 95% confidence interval) was returned, indicating comparable efficacy between MBSR and pharmacological interventions.

Another randomized control trial followed 60 adults with drug-resistant epilepsy from Hong Kong for 4.5 months, assigned to either: (1) MBSR group with 6 biweekly sessions for 2.5 hours; or (2) control, receiving 6 biweekly social support sessions for 2.5 hours (Tang, Poon & Kwan, 2015). Statistically significant improvements were demonstrated for: (a) depression (-5.53, 95% confidence interval -7.28 – -3.79 versus -4.07, 95% confidence interval -6.62 – -1.31,  $p < 0.05$ ); (b) anxiety (-5.37, 95% confidence interval -8.52 – -2.21 versus -2.83, 95% confidence interval -6.43 – -0.76,  $p < 0.05$ ); (c) quality of life (6.23, 95% confidence interval 4.22–10.40 versus 3.30, 95% confidence interval 1.03–5.58,  $p < 0.05$ ); (d) cognitive effect (6.43, 95% confidence interval -1.90-14.76 versus 2.27, 95% confidence interval -1.60–6.14,  $p < 0.05$ ); and (e) cognitive function (1.57, 95% confidence interval 0.66–2.47 versus 0.40, 95% confidence interval 0.08–0.72,  $p < 0.05$ ), in the intervention arm compared to the control arm, respectively (Tang, Poon & Kwan, 2015). Thus, in addition to mood effects, mindfulness may potentially be beneficial for the mitigation of neurocognitive deficits.

In a randomized control trial that investigated 332 adult women who survived breast cancer from Florida for 12 weeks, allotted into either: (1) MBSR intervention, consisting of 6 weekly sessions for 2 hours, paired with 15-45 minutes of daily at-home practice; or (2) a control group, receiving treatment as usual, on a non-intervention waitlist (Lengacher et al., 2016). There were statistically significant improvements to: (a)

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anxiety ( $38.62 \pm 12.3$  to  $30.62 \pm 12.8$  versus  $35.86 \pm 11.29$  to  $31.76 \pm 13.2$ ,  $p = 0.007$ ); (b) fear of breast cancer recurrence ( $12.29 \pm 5.64$  to  $9.77 \pm 5.34$  versus  $10.75 \pm 5.57$  to  $9.85 \pm 5.4$ ,  $p = 0.001$ ); (c) overall quality of life ( $62.63 \pm 21.24$  to  $67.93 \pm 19.87$  versus  $66.29 \pm 8.79$  to  $68.28 \pm 21.28$ ,  $p = 0.05$ ); (d) fatigue severity ( $16.38 \pm 8.79$  to  $12.22 \pm 7.59$  versus  $14.48 \pm 8.36$  to  $13.27 \pm 8.71$ ,  $p = 0.002$ ); (e) fatigue interference with daily life ( $30.27 \pm 21.78$  to  $20.25 \pm 16.35$  versus  $25.51 \pm 19.93$  to  $21.45 \pm 18.2$ ,  $p = 0.006$ ); and marginally significant reductions in: (f) depression ( $10.87 \pm 6.89$  to  $8.12 \pm 5.45$  versus  $10.04 \pm 6.46$  to  $8.82 \pm 6.05$ ,  $p = 0.06$ ), in the MBSR arm as compared to the control arm, respectively (Lengacher et al., 2016). The research group also published a follow-up study using the same data, which demonstrated that there were statistically significant improvements as multi-symptom clusters in: (1) the psychological domain: ( $p = 0.007$ ), e.g., depression, anxiety, stress, and emotional well-being; and (2) the fatigue domain: ( $p < 0.001$ ), e.g., fatigue, sleep and drowsiness (Reich et al., 2017).

One more recent nonrandomized control trial examined 33 adult Hispanic women from Texas, who were in 24 months of remission from breast cancer, assigned to an intervention of 8 weekly MBSR sessions for 2 hours, along with daily at-home practice (Elimimian et al., 2020). There were statistically significant reductions in anxiety ( $-2.39 \pm 2.28$ ,  $p = 0.04$ ) and depression ( $-2.27 \pm 2.13$ ,  $p = 0.04$ ), as well as increases in mental quality of life ( $4.07 \pm 3.59$ ,  $p = 0.03$ ), as compared to the baseline, after the study (Elimimian et al., 2020).

A randomized control trial followed 116 adult war veterans with PTSD from Minnesota for nine weeks, with a 2-month follow-up, assigned to either: (1) MBSR intervention, consisting of 8 weekly sessions for 2.5 hours, along with a daylong retreat

during week 9; or (2) a control group, receiving nine weekly present-centered therapy sessions for 1.5 hours (Polusny et al., 2015). The participants exhibited statistically significant improvements for: (a) PTSD, along two metrics, the PTSD Checklist – Military [PCL-M] ( $6.44 \pm 3.10, p < 0.001$ ) and the Clinician-Administered PTSD Scale [CAPS] ( $7.89 \pm 4.01, p = 0.004$ ); (b) quality of life ( $5.22 \pm 3.49, p = 0.004$ ); and (c) mindfulness ( $9.73 \pm 5.31, p < 0.001$ ), as a between-groups difference, from baseline to follow-up (Polusny et al., 2015). There were also statistically significant results post-treatment, at the completion of the 9-week intervention for: (a) PTSD, PCL-M score ( $4.95 \pm 3.03, p = 0.003$ ); and (b) mindfulness ( $9.14 \pm 5.23, p < 0.001$ ); but non-significant results for: (c) PTSD, CAPS score ( $2.35 \pm 5.1, p = 0.37$ ); or (d) quality of life ( $3.10 \pm 3.39, p = 0.08$ ) (Polusny et al., 2015).

In further of the mindfulness domain and overall emotional status, another randomized control trial explored 56 generally healthy adults from North Carolina for eight weeks, allocated to either: (1) MBSR group, receiving eight weekly sessions for 2.5 hours, paired with 45 minutes of daily at-home practice; or (2) control group on a non-intervention waitlist (Robins et al., 2012). The authors found statistically significant improvements to: (a) mindfulness ( $121.6 \pm 20.31$  to  $138.35 \pm 13.27$  versus  $125.10 \pm 22.13$  to  $125.76 \pm 21.99, p = 0.001$ ); (b) fear over loss of ability to regulate emotions ( $129.31 \pm 35.08$  to  $105.60 \pm 26.28$  versus  $121.73 \pm 38.20$  to  $115.48 \pm 30.99, p = 0.007$ ); (c) anger expression ( $12.45 \pm 2.76$  to  $11.55 \pm 1.88$  versus  $15.33 \pm 4.94$  to  $15.71 \pm 4.54, p = 0.005$ ); and (d) emotional instability ( $89.66 \pm 22.72$  to  $72.00 \pm 12.93$  versus  $82.89 \pm 25.21$  to  $83.38 \pm 19.27, p = 0.009$ ), in the MBSR arm compared to the control arm, from baseline to completion, respectively (Robins et al., 2012).

However, as stated previously, some of the evidence, while demonstrating positive trends, has not found mindfulness therapies to be superior to treatment as usual in the mental health domain. In a randomized control trial that followed 424 adults with major depressive disorder in remission and on antidepressants from the United Kingdom for 24 months, which delineated them into either: (1) MBSR intervention, consisting of 8 weekly sessions for 2.25 hours; or (2) a control group, using maintenance anti-depressants (Kuyken et al., 2015). This study did not find statistically significant improvements for depression by two metrics: (a) GRID-Hamilton Rating Scale for Depression [GRID-HAMD] ( $4.8 \pm 4.3$  to  $4.7 \pm 4.8$  versus  $4.6 \pm 4.3$  to  $4.7 \pm 5.7$ ,  $p = 0.55$ ); or (b) Beck Depression Inventory [BDI] ( $13.8 \pm 12.4$  to  $11.6 \pm 10.9$  versus  $14.4 \pm 10.1$  to  $11.9 \pm 10.7$ ,  $p = 0.21$ ), from baseline to study completion, in the MBSR arm compared to the control group, respectively (Kuyken et al., 2015).

Similarly, an earlier short-term, randomized control trial examined 274 adults with major depressive disorder in remission from the United Kingdom for eight weeks, assigned to one of three groups: (1) MBSR, consisting of 8 weekly mindfulness-based cognitive therapy sessions for 2 hours, along with the usual standard of care; (2) control, receiving only treatment as usual; or (3) cognitive psychological education (CPE), consisting of 8 weekly sessions for 2 hours, also with treatment as usual (Williams et al., 2014). Statistically significant benefits were not determined for: (a) MBSR versus control (0.68, 95% confidence interval 0.42-1.22,  $p = 0.13$ ); or (b) MBSR versus CPE (0.88, 95% confidence interval 0.57-1.34,  $p = 0.56$ ), as expressed as hazard ratios concerning depression relapse (Williams et al., 2014).



One final randomized control trial investigated 68 Dutch adults with major depressive disorder in remission and on antidepressants for 15 months, allocated to either: (1) MBSR group, consisting of 8 weekly sessions for 2.5 hours, while utilizing maintenance antidepressants; or (2) a control group, receiving only their maintenance antidepressants (Huijbers et al., 2015). This study did not find statistically significant additive benefits of MBSR over control to: (a) overall quality of life ( $3.7 \pm 0.7$  to  $3.8 \pm 0.7$  versus  $3.8 \pm 0.8$  to  $3.8 \pm 1.0$ ,  $p = 0.68$ ); or (b) quality of life in the mental domain: ( $19.3 \pm 3.2$  to  $20.5 \pm 3.3$  versus  $20.1 \pm 3.9$  to  $20.4 \pm 3.7$ ,  $p = 0.28$ ), from baseline to study completion, respectively (Huijbers et al., 2015).

However, despite the lack of definitive superiority, further research needs to be conducted, as the emerging evidence continues to suggest that there are emotional, spiritual, and neurocognitive benefits, including the potential for discontinuation of antidepressant medications, through the use of mindfulness-based cognitive therapies (Wentink, 2019).

This stress reduction has also shown benefit in improving cardiometabolic risk markers, e.g., hypertension (Solano López, 2018). In a randomized control trial, 60 Iranian adults with cardiovascular disease were examined for three months, assigned to either: (1) MBSR group, consisting of eight weekly sessions for two hours, along with daily at-home practice; or (2) a control group, receiving treatment as usual (Jalali et al., 2019). This study demonstrated statistically significant improvements to: (a) self-efficacy ( $53.82 \pm 10.59$  to  $60.80 \pm 5.91$  versus  $53.20 \pm 9.22$  to  $50.30 \pm 7.48$ ,  $p = 0.001$ ); and (b) quality of life ( $90.76 \pm 7.21$  to  $103.80 \pm 9.35$  versus  $88.80 \pm 6.96$  to  $87.83 \pm 8.95$ ,

$p = 0.001$ ), in the MBSR arm, compared to the control group, from baseline to completion, respectively (Jalali et al., 2019).

Another single-blind randomized control trial investigated 60 Iranian adults with cardiovascular disease for eight weeks, allotted to either: (1) MBSR group, consisting of 8 weekly sessions for 2.5 hours, paired with 15-45 minutes of daily at-home practice; or (2) control group, receiving treatment as usual (Momeni et al., 2016). The results demonstrated statistically significant improvements to: (a) systolic blood pressure ( $134.16 \pm 7.99$  to  $118.33 \pm 7.46$  versus  $131.16 \pm 8.06$  to  $128.33 \pm 12.05$ ,  $p < 0.001$ ); (b) perceived stress ( $30.25 \pm 9.59$  to  $16.74 \pm 4.76$  versus  $37.50 \pm 2.73$  to  $33.46 \pm 5.91$ ,  $p < 0.001$ ); and (c) state anger ( $27.33 \pm 7.09$  to  $14.37 \pm 3.96$  versus  $27.13 \pm 5.10$  to  $28.03 \pm 3.96$ ,  $p < 0.001$ ); in the intervention group as compared to the control group, from baseline to completion of the study, respectively (Momeni et al., 2016).

One final randomized control trial followed 324 Dutch adults with cardiovascular disease were followed for 12 months, allocated to either: (1) MBSR intervention, consisting of 12 weekly sessions delivered online; or (2) control, receiving treatment as usual (Gotink et al., 2017). Marginally significant improvements were found for: (a) exercise capacity ( $537.5 \pm 7.0$  to  $539.3 \pm 549.0$  versus  $81.6 \pm 81.6$  to  $532.9 \pm 82.8$ ,  $p = 0.055$ ); and (b) systolic blood pressure ( $127.5 \pm 16$  to  $123.8 \pm 17$  versus  $125.4 \pm 15$  to  $125.4 \pm 17$ ,  $p = 0.085$ ), in the intervention group compared to the control group, from baseline to follow-up, respectively (Gotink et al., 2017). However, when the authors conducted an as-treated analysis, systolic blood pressure was found to have exhibited a statistically significant improvement versus the control group ( $129.7 \pm 22.8$  to  $124.4 \pm 27.3$  versus  $125.8 \pm 23.8$  to  $126.1 \pm 29.2$ ,  $p = 0.045$ ) (Gotink et al., 2017).

Regarding weight benefits specifically, an additional potential mechanism is through improvements in self-regulation of caloric intake, which makes sense given the complex interplay between mood and dietary choices (Warren, Smith, & Ashwell, 2017). In a randomized control pilot study, 47 overweight and obese adult women from California with excess stress were examined for four months, assigned to either: (1) MBSR intervention, consisting of nine sessions for 2.5 hours, along with no more than 30 minutes of at-home practice, six days per week; or (2) a non-intervention waitlist (Daubenmier et al., 2011). The authors found statistically significant improvements to: (a) mindfulness, in the awareness domain: ( $0.25 \pm 0.5$  versus  $-0.7 \pm 0.3$ ,  $p = 0.02$ ), and the observation domain: ( $0.26 \pm 0.5$  versus  $-0.08 \pm 0.3$ ,  $p = 0.01$ ); (b) anxiety ( $-0.23 \pm 0.4$  versus  $0.00 \pm 0.4$ ,  $p = 0.045$ ); and (c) external-based eating, i.e., eating provoked by external stimuli, e.g., sight, smell or presence of food ( $-0.41 \pm 0.4$  versus  $-0.09 \pm 0.4$ ,  $p = 0.02$ ), in the MBSR arm compared to the control arm, respectively (Daubenmier et al., 2011).

A later randomized control trial by the same authors followed 194 obese adults from California for 18 months, allotted into either: (1) MBSR group, consisting of 16 sessions for 2.5 hours, along with no more than 30 minutes at-home practice, six days per week, as well as diet and exercise advice; or (2) a control group, receiving 16 sessions of progressive muscle relaxation and cognitive behavior training for 2.5 hours, also with diet and exercise advice (Daubenmier et al., 2016). There were statistically significant reductions to: (a) fasting blood glucose ( $-0.31 \pm 0.1$  versus  $3.8 \pm 1.2$ ,  $p = 0.01$ ); and (b) triglyceride/HDL ratio ( $-0.27 \pm 0.1$  versus  $0.9 \pm 0.1$ ,  $p = 0.07$ ), in the intervention arm compared to the control arm, from baseline to follow-up, respectively (Daubenmier et al.,

2016). The authors also noted that although not reaching significance ( $p = 0.24$ ), there was more weight loss in the MBSR group ( $-4.2 \pm 1.0$  kg) than the control group ( $-2.4 \pm 1.0$  kg) (Daubenmier et al., 2016).

One more recent randomized control pilot trial examined 54 generally healthy adolescents at-risk for weight regulation issues from Colorado for six months, assigned to either: (1) MBSR, consisting of six weekly one hour sessions, along with approximately ten minutes of at-home daily practice; or (2) control, receiving six weekly health education classes for one hour (Shomaker, & Berman, et al., 2019). Statistically significant improvements were determined for: (a) food reward sensitivity, i.e., preference to food over an alternative reward ( $53.82 \pm 10.59$  to  $37.99 \pm 9.72$  versus  $53.26 \pm 12.57$  to  $61.67 \pm 10.47$ ,  $p = 0.01$ ); and (b) stress-eating ( $745.51 \pm 70.59$  to  $786.00 \pm 66.92$  kcal versus  $779.25 \pm 76.03$  to  $989.09 \pm 72.08$  kcal,  $p = 0.05$ ), in the MBSR group compared to the control group, from baseline to study completion, respectively, (Shomaker, & Berman, et al., 2019).

Unfortunately, this relationship extends beyond simply overweight and obesity, as there is a strong correlation between diabetes and “mental” health issues, e.g., depression and anxiety (Dziemidok, Makara-Studzińska, & Jarosz, 2011). A recent short-term randomized control pilot trial followed 33 adolescent girls with depression, at-risk for T2DM for six weeks, assigned to either: (1) MBSR, consisting of 6 weekly 1 hour sessions, along with approximately 10 minutes of at-home daily practice; or (2) control, receiving six weekly cognitive behavioral therapy sessions for 1 hour (Shomaker et al., 2017). The results demonstrated statistically significant reductions in: (a) depression ( $-11.17 \pm 1.36$  versus  $-7.65 \pm 1.35$ ,  $p = 0.04$ ); (b) insulin resistance ( $-0.39 \pm 0.38$  versus

0.73 ± 0.34,  $p = 0.02$ ); and (c) fasting serum insulin: (-0.50 ± 0.86 μU/mL versus 2.00 ± 0.85 μU/mL,  $p = 0.04$ ), in the MBSR group compared with the control group, respectively (Shomaker et al., 2017). In a follow-up of that study, the same authors found that after one year, statistically significant reductions remained for: (a) depression (-14.17 ± 4.05 versus -7.65 ± 4.02,  $p = 0.03$ ); and (b) insulin resistance (-1.26 ± 0.82 versus 0.57 ± 0.79,  $p < 0.01$ ), in the intervention group contrasted with the control group, respectively (Shomaker, & Pivarunas, et al., 2019).

Another randomized control trial explored 139 Dutch adults with types 1 and 2 diabetes mellitus and low emotional well-being for eight weeks, allocated to either: (1) MBSR intervention, consisting of 8 weekly sessions for 2 hours, along with 30 minutes of at-home practice, five days per week; or (2) control, on a non-intervention waitlist receiving treatment as usual (van Son et al., 2013). There were statistically significant improvements to: (a) stress (19.5 ± 6.0 to 17.3 ± 6.9 versus 20.5 ± 5.9 to 19.1 ± 6.4,  $p < 0.001$ ); (b) depressive symptoms (7.9 ± 3.8 to 6.4 ± 4.3 versus 8.9 ± 3.9 to 8.5 ± 4.2,  $p = 0.006$ ); (c) anxiety (8.4 ± 3.3 to 7.5 ± 4.1 versus 9.2 ± 3.6 to 9.0 ± 3.7,  $p = 0.019$ ); (d) mental quality of life (33.9 ± 11.0 to 42.9 ± 10.7 versus 32.5 ± 11.6 to 35.7 ± 12.5,  $p = 0.003$ ); and (e) physical quality of life (41.5 ± 9.9 to 43.5 ± 10.5 versus 38.9 ± 11.4 to 38.5 ± 11.7,  $p = 0.032$ ), in the MBSR arm compared to the control arm, from baseline to completion, respectively (van Son et al., 2013).

In a nonrandomized control trial, 225 low-income adult pregnant women from California were followed for six months, assigned to either: (1) MBSR, consisting of 8 weekly sessions for 2 hours, paired with at-home practice; or (2) control, receiving treatment as usual (Epel et al., 2019). Statistically significant reductions were found in:

(a) perceived stress ( $19.1 \pm 6.6$  to  $15.6 \pm 5.8$  versus  $18.4 \pm 6.6$  to  $17.0 \pm 7.4$ ,  $p = 0.04$ ); and (b) depressive symptoms ( $7.6 \pm 5.6$  to  $4.5 \pm 3.7$  versus  $6.8 \pm 4.9$  to  $6.1 \pm 4.5$ ,  $p = 0.007$ ); as well as significantly better (c) oral glucose tolerance at the 24-week gestation point ( $100.3 \pm 23.2$  versus  $111.8 \pm 27.7$ ,  $p = 0.009$ ), in the intervention group compared to the control group, from baseline to study completion, respectively (Epel et al., 2019).

One final recent nonrandomized control trial analyzed 45 obese Mexican children with anxiety issues for 8 weeks, assigned to either: (1) MBSR group, consisting of 8 weekly sessions for 2 hours, along with at-home practice and conventional hypocaloric nutritional advice; or (2) control, receiving only the same nutritional advice (López-Alarcón et al., 2020). From baseline to follow-up, statistically significant reductions were determined for: (a) anxiety ( $-6.21 \pm 1.10$  versus  $0.66 \pm 0.64$ ,  $p < 0.001$ ); (b) serum ghrelin: ( $-0.71 \pm 0.37$  pg/mL versus  $0.83 \pm 0.75$  pg/mL,  $p = 0.026$ ); and (c) serum cortisol ( $-1.42 \pm 0.94$  µg/dL versus  $2.26 \pm 0.93$  µg/dL,  $p = 0.015$ ), in the MBSR arm compared to the control arm, respectively (López-Alarcón et al., 2020). The authors also found statistically significant ( $p = <0.001$ ) within-group body fat percentage loss for the MBSR ( $-1.28 \pm 0.25\%$ ) (López-Alarcón et al., 2020). However, when compared between groups with the control group ( $-1.24 \pm 0.91\%$ ), the results did not reach significance ( $p = 0.527$ ) (López-Alarcón et al., 2020).

Interestingly, the literature has also found an association between childhood trauma and food addiction, with the subsequent development of overweight, obesity, and metabolic syndrome (Stojek et al., 2019). This discovery may help provide a bridge between some of the psychological and physiological conditions, as well as where “mindfulness” and other spirituality-derived modalities can have particular efficacy.

While the previously discussed papers by Williams et al. (2014) and Kuyken et al. (2015) did not find MBSR to lead to statistically significant improvements over pharmaceutical interventions in their overall samples, both did find considerable benefit in subpopulations of individuals exposed to childhood abuse.

Williams et al., 2014 determined there to be hazard ratios of 0.543 (95% confidence interval, 0.22-0.87,  $p = 0.01$ ) and 0.61 (95% confidence interval, 0.34-1.09,  $p = 0.09$ ) in the MBSR group versus control group and cognitive psychological education groups, respectively, thus suggesting it is better than treatment as usual, but likely only as efficacious as CPE. In contrast, Kuyken et al. (2015) found that when compared to the control group, depression relapse has a hazard ratio of 0.53 (95% confidence interval, 0.29-0.95,  $p = 0.03$ ) in the subpopulation, indicating it may be superior to merely using maintenance antidepressants.

Moving beyond maladaptive eating patterns to the misuse of narcotics and alcohol, a randomized control pilot trial that followed 36 adults with substance abuse problems for 12 weeks, assigned to either: (1) MBSR intervention, consisting of 9 weekly sessions for 1 hour; or (2) control, receiving 12 weekly cognitive behavioral therapy sessions for 1 hour (Brewer et al., 2009). The MBSR group exhibited statistically significant improvements to anxiety along two metrics: (a) Treatment Credibility Scale [TCS] ( $1.5 \pm 2.1$  versus  $4.6 \pm 1.5$ ,  $p = 0.01$ ); and (b) Differential Emotion Scale [DES] ( $1.5 \pm 3.9$  versus  $7.0 \pm 3.8$ ,  $p = 0.03$ ), as compared to the control group, from baseline to completion, respectively (Brewer et al., 2009). Moreover, while not reaching close to statistical significance ( $p = 0.65$ ), the authors also found that those receiving MBSR

approximately halved stress-induced drug cravings when compared to CBT ( $1.1 \pm 3.7$  versus  $2.0 \pm 3.1$ ).

Despite these potentially promising results and the claims on neutrality, given the Buddhist presuppositions built into both the theory and practice of MBSR, many might prefer the use of modalities that accurately represent their beliefs (Knabb, 2012).

Collectively, the empirical evidence and the functional similarity provides further indication that there are likely benefits to further exploration of Eastern Orthodox Christian ascetic practices.



### CHAPTER 3: METHODS

**Search procedure.** A careful review of the literature related to Orthodox Christian ascetic practices was conducted. The review highlighted the following topics: (a) fasting (b) *hesychastic* prayer, (c) chronic disease, and (d) mental health.

**Libraries used.** There was only one library used for the search for sources for this project: The Health Professions Divisions Library at the University of Bridgeport.

**Search engines and databases used.** The following databases were used to search for project sources: PubMed, Google Scholar, ResearchGate, and Academia.edu.

**Search terms.** Several search terms and keywords were used to identify project sources. The search terms included (a) Orthodox Christianity, (b) fasting, and (c) prayer.

**Boolean strings.** Boolean strings were considered for the literature search. One Boolean string was used: Orthodox Christianity AND health.

**Age of the sources.** The relevant literature has been reviewed. Sources from the last 19 years have been considered for inclusion in the review of literature. Pertinent historical or seminal articles and writing of the Church Fathers were also considered.

**Inclusion criteria.** There were four inclusion criteria. Inclusion criteria included (a) literature published since the year 2000, except historical sources; (b) English-language text; (c) peer-reviewed articles, unless providing theoretical justification; and (d) books relating to Orthodox Christianity and health.

**Exclusion criteria.** There were three exclusion criteria. The exclusion criteria included (a) literature published before the year 2000, except historical sources; (b) text not published in English; and (c) articles not peer-reviewed, unless providing theoretical justification.

## CHAPTER 4: RESULTS

Eastern Orthodox Christian ascetic practices have nearly two thousand years of traditional application, but the research specifically into its clinical efficacy has been wanting. As such, it was necessary to comparatively examine ostensibly similar practices from other traditions for evidence on a physiological and psychological level. However, it was also important to delineate the *telos* of these practices, such that the potential for improvement throughout other dimensions of health, precisely the spiritual element was well articulated. While not imposing a false dialectical tension between the material and the spiritual, it is possible to explore the benefits of these practices.

### **Research Question 1: Assessment of the Empirical Efficacy of Fasting in the Improvement of Cardiometabolic and “Mental” Health**

Fasting is nearly universally practiced throughout various cultures worldwide. As illustrated in Tables 2-4, in its numerous permutations IF has been associated with physiological benefits including: (1) reduced body fat and body mass; (2) maintenance of lean body mass; (3) improved body composition; (4) improved muscular strength and endurance; (5) improved glucoregulation and insulin sensitivity; (6) improved systolic blood pressure regulation; (7) improved cardiometabolic biomarker profiles; (8) improved hormonal modulation; and (9) reduced oxidative stress. Given the established biochemical changes, this makes sense inasmuch as the shifts in substrate metabolism should induce the liberation of adipose stores, as well as reduce inflammation, thereby reducing the disease burden.

Sarri et al. (2003) found statistically significant improvements to BMI, total cholesterol, and LDL cholesterol in those following an Orthodox Christian fasting protocol, as compared to non-fasters. These same researchers later determined that the fasting population consumed: (a) significantly higher amounts of dietary iron and folate; (b) significantly lower saturated fat and cholesterol; but also (c) insufficient intakes of dietary calcium, as compared to non-fasters (Sarri et al., 2004). Further studies by this group also found the Orthodox Christian fasters to exhibit statistically significant improvements to serum retinol, serum  $\alpha$ -tocopherol, adipose docosahexaenoic acid, serum ferritin, total iron-binding capacity, and diastolic blood pressure, when compared to non-fasting control groups (Sarri et al., 2005; 2007; 2008; 2009).

Papadaki et al. (2008) demonstrated that a self-referential population significantly improved their systolic blood pressure, total cholesterol, LDL, and dietary fiber intake, during the Orthodox Christian fasting period, as compared to the non-fasting period. Unfortunately, similar to Sarri et al. (2004), their dietary calcium intake was also significantly reduced, as well. In both cases, the elimination of dairy products was the predominant contributing factor. Similarly, Karras et al. (2017) found significant reductions in caloric intake and dietary fat, as well as dietary calcium, but increases to dietary magnesium and vitamin D on an Orthodox fasting day, as compared to a non-fasting day. In a later study, these same researchers also discovered: (a) that Orthodox fasters have significantly lower dietary fat intake on fasting days; and (b) Orthodox monks exhibit statistically significantly better serum triglycerides, serum insulin, serum glucose and insulin resistance, as compared to general Orthodox fasters (Karras et al., 2019).

Elshorbagy et al. (2017) demonstrated statistically significant improvements over time for total cholesterol, LDL cholesterol, plasma leucine, plasma isoleucine, and plasma valine, collectively indicating improved cardiovascular function in a group of Orthodox Christian fasters. A self-referential study found Lenten fasting to induce statistically significant contradictory, yet likely compensatory, reductions to the blood coagulation biomarkers: coagulation factor VII and APTT ratio (Liali et al., 2015). Similarly, a later self-referential trial determined Lenten fasting induces a statistically significant decrease in coagulation factor VII and APTT ratio, but also significantly increased plasma total antioxidant capacity (Makedou et al., 2018).

It is pertinent to note that in at-risk populations, e.g., pregnant/lactating Ethiopian mothers and infants, Oriental Orthodox fasting was associated with statistically significant reductions in dietary diversity, weight-for-age, and height-for-age (Desalegn et al., 2018; 2019). Similarly, another study with Oriental Orthodox infants found that their mothers' lack of consumption of animal foods during Lent to significantly reduce their dietary diversity score (Kumera, Tsedal, & Ayana, 2018). However, as these studies were all cross-sectional and conducted in impoverished regions of Ethiopia, beyond the distinctions in practice, their results are not as generalizable to most populations.

Nematy et al. (2012) found statistically significant reductions from baseline to coronary heart disease risk score, total cholesterol, LDL cholesterol, triglycerides, and systolic blood pressure in a self-referential Ramadan fasting group. Similarly, another self-referential study determined Ramadan fasting was associated with a significant decrease in weight loss, systolic blood pressure, diastolic blood pressure, triglycerides, fasting glucose, leptin, plasma tumor necrosis factor  $\alpha$ , and c-reactive protein, as

compared to the periods before and after Ramadan fasting (Alam et al., 2019). Al-Shafei et al. (2014) demonstrated that Ramadan fasting hypertensives statistically significantly: (a) lowered their arterial pulse pressure, systolic blood pressure, serum triglycerides, and LDL cholesterol; and (b) increased their HDL cholesterol and blood glutathione.

However, a study examining individuals with two or more cardiovascular risk factors found Ramadan fasting to induce transient, yet statistically significant, negative changes to blood glucose, total cholesterol, triglycerides, and insulin, as well as Hemoglobin A<sub>1c</sub> in the diabetic sub-group (Beltaief et al., 2019). Fortunately, a different pilot trial on adults with coronary artery disease determined that Ramadan fasting did not result in statistically significant differences in chest pain incidence or levels of chest pain and dyspnea (Mousavi et al., 2014). Moreover, from an absolute value perspective, the fasting arm exhibited lower levels in both measures (Mousavi et al., 2014). Thus, while it is essential to be mindful of the potential for deleterious effects, the overall prospect appears to be towards cardioprotective benefits.

Alsubheen et al. (2017) demonstrated statistically significant improvements to body fat percentage and systolic blood pressure, but also found that Ramadan fasting resulted in significantly lower physical activity and total energy expenditure. Conversely, in another study, while physical activity was significantly decreased during the fasting period, resting metabolic rate and total energy expenditure did not reach significance (Lessan et al., 2018).

Norouzy et al. (2013) demonstrated statistically significant improvements to body weight and body fat percent in self-referential populations following Ramadan fasting. Similarly, another self-referential trial found significant reductions from baseline for

body weight, BMI, plasma glucose, plasma insulin, and plasma adiponectin: (Gnanou et al., 2015). One more study determined that Ramadan fasting can induce statistically significant changes to plasma adiponectin and plasma tumor necrosis factor  $\alpha$  in obese populations (Mushtaq et al., 2019).

Ajabnoor et al. (2014) found Ramadan fasting to induce statistically significant changes to morning measurements of serum adiponectin, serum leptin, and insulin resistance. However, in another self-referential study during Ramadan, serum adiponectin, serum leptin, and serum ghrelin were not found to change significantly, but despite not reaching significance, serum adiponectin was nearly double during the fasting period, as compared to afterward (Mesci et al., 2012).

Awwad et al. (2012) discovered that Lebanese mothers following Ramadan fasting were associated with statistically significant reductions in newborn birth weight and non-statistically significant increases in the incidence of preterm births (Awwad et al., 2012). However, later studies did not duplicate these results, as statistical significance was not found for either newborn birth weight or preterm births (Petherick, Tuffnell, & Wright, 2014; Savitri et al., 2018). Another promising study also found that Ramadan fasting did not result in a significantly higher incidence of preterm births, but did statistically significantly reduce the rates of gestational diabetes (Safari, Piro, & Ahmad, 2019). Thus, similar to the case of individuals with cardiovascular disease, while vigilant monitoring is essential, fasting does appear to be safe and efficacious in pregnant women.

Antoni et al. (2018) determined that intermittent fasting was associated with statistically significant reductions to systolic blood pressure, as compared to general

caloric restriction. An alternate day IF trial found significant improvements to body fat mass, LDL cholesterol, and HDL cholesterol, which were compounded by the inclusion of an exercise protocol (Bhutani et al., 2013). Hirsch et al. (2013) demonstrated statistically significant improvements to total cholesterol: HDL ratio and non-significant reductions to bodyweight in the IF group, as compared to the control group. A randomized control pilot trial found statistically significant decreases to relative weight change and triglycerides, as well as superior, but non-significant weight loss in the IF arm versus the CR arm (Catenacci et al., 2019).

Harvie et al. (2013) demonstrated that IF resulted in statistically significant reductions to body fat mass and insulin resistance, as compared to CR. In a randomized, active comparator pilot trial, a Mediterranean-style diet combined with a 5:2 IF model resulted in statistically significant reductions to visceral adipose tissue and total fat mass, when compared to a euenergetic DASH diet (Panizza et al., 2019). Hoddy et al. (2014) found similar statistically significant reductions to body weight, visceral fat mass, and systolic blood pressure in three different alternate day fasting strategies; thus, indicating a degree of flexibility concerning meal timing during IF protocols. Another randomized control trial discovered IF to produce a statistically significant decrease in body fat mass and a non-significant increase in fat-free mass (Moro et al., 2016). Recent pilot trials on time-restricted IF protocols have also shown statistically significant reductions to bodyweight and systolic blood pressure (Gabel et al., 2018; Anton, 2019).

Tinsley et al. (2017) demonstrated the ability of a TRF to increase muscle strength and endurance, as well as decreased body fat mass, compared to a normal diet. Similarly, a later randomized control trial by the same researchers found TRF can increase muscular

hypertrophy and performance, with associated fat mass loss, versus the normal control diet (Tinsley et al., 2019).

A lengthier one-year randomized control trial did not find a statistically significant difference in weight loss between IR and CR (Headland, Clifton, & Keogh, 2018). Similarly, two other randomized control trials by the same research group did not discover IF to exhibit statistical significance for body fat mass or hemoglobin A1c, as compared to CR (Carter, Clifton, & Keogh, 2016; 2018).

Conley et al. (2018) also did not find IF to be statistically superior to CR for weight loss, waist circumference, and systolic blood pressure. Similarly, Varady et al. (2019) did not discover statistically significant improvements for body fat mass, LDL cholesterol, or triglycerides in the IF group, as compared to the control group. Another randomized control trial also did not demonstrate IF to induce statistical significance in changes to bodyweight or HDL cholesterol versus the control group (Trepanowski et al., 2017). It is pertinent to note that in all of these later trials, although there was no significant difference between groups, all of the groups did exhibit improvements in these domains. Thus, while IF was not superior to CR in these studies, fasting was still found to be efficacious.

As demonstrated in Tables 5, fasting has been found to induce psychological benefits, including: (1) improved mood and vigor; (2) decreased anger and tension; (3) increased mental flexibility; (4) decreased stress; (5) decreased anxiety and depression; and (6) decreased insomnia; however, some negative psychological consequences have included increased anger, irritability, and pride. Similarly, from a purely physiological perspective, these mental changes make sense. The energetic shift from wild fluctuations



in blood glucose towards ketone metabolism, should improve hormonal regulation and cognitive functioning, resulting in mood improvement (Fond et al., 2013; Carter, Clifton, & Keogh, 2016; Solianik et al., 2016; Alam et al., 2019; Malinowski et al., 2019).

Conversely, the deleterious effects can equally be partially explained by poor glycemic control, which often occurs during poorly implemented or adhered to dietary protocols.

Moving beyond the purely materialist aspects of fasting, it has the potential to help with the development of *egkrateia*, or self-control. Most overeating is done either mindlessly or in a coping fashion to stressful situations, which are both aspects of the same existential issue, with the latter being the more apparent manifestation. Thus, in the establishing of a higher *telos*, fasting provides a means to undertake the voluntary suffering associated with caloric restriction willfully.

In terms of results, in a single-arm clinical trial, Ramadan fasting was demonstrated to significantly increase serotonin and brain-derived neurotrophic factor, as well as non-significantly increase dopamine (Bastani, Rajabi, & Kianimarkani, 2017). Koushali et al. (2015) found Ramadan fasting to significantly reduce stress and depression, as well as non-significantly decrease anxiety. Similarly, another study discovered statistically significant reductions in depression, anxiety, and insomnia in a group engaging in Ramadan fasting (Ghazi et al., 2018).

From a cognitive performance perspective, Ramadan fasting was discovered to induce statistically significant reductions in task error rate, compared to a non-fasting control group (Ghayour Najafabadi et al., 2015). Lieberman et al. (2008) conducted a double-blind placebo randomized control trial, which did not find any significant differences in cognition or depression during a 48-hour non-nutritive gel fast, but did find

statistically lower levels of satiety, versus those receiving calorically dense gels.

Conversely, a similar recent trial found the non-nutritive group to exhibit statistically greater anger, depression, and confusion, as compared to those receiving a caloric gel (Giles et al., 2019).

In a self-referential 48-hour water fast, cognitive flexibility and anger were significantly increased as compared to the baseline (Solianik et al., 2016). Similarly, a randomized control trial demonstrated TRF to induce statistically significantly greater levels of irritability, as well as senses of achievement and pride, as compared to the non-fasting baseline (Watkins & Serpell, 2016). Synthesizing these findings, fasting appears to be able to improve mental acuity, despite the lack of nutritive intake. However, one needs to be aware not to let the passions take over.

Teng et al. (2011) demonstrated that TRF is associated with statistically significant improvements to vitality and body fat mass, as compared to the control group. Similarly, another randomized control trial found TRF to significantly reduce confusion, total mood disturbance, and body fat mass, versus the control group (Hussin et al., 2011).

Table 2.  
*Orthodox Christian Fasting – PICOTS Table*

Author(s)	Population		Group	Outcome(s)		Timing	Study Type
	Age (years)	Sample Size		Study Criteria	Study Result		
Sarri et al. (2003)	Healthy Orthodox Christian adults from Crete, Greece i) 42 ± 12 ii) 38 ± 9	n = 120	i) Eastern Orthodox Christian fasting ii) Control – Non-fasters	1) Body mass index (Δ%): 2) Total cholesterol (Δ%): 3) LDL cholesterol (Δ%):	-1.5**** -12.5**** -15.9****	1 year	Prospective, longitudinal case-control study
Sarri et al. (2004)	Healthy Orthodox Christian adults from Crete, Greece i) 42 ± 12 ii) 38 ± 9	n = 120	i) Eastern Orthodox Christian fasting ii) Control – Non-fasters	1) Dietary calcium (per 4184 mJ): 2) Dietary iron (per 4184 mJ): 3) Dietary folate (per 4184 mJ): 4) Dietary saturated fat: 5) Dietary cholesterol (per 4184 mJ):	i) -133.1 ± 24.0**** ii) -11.2 ± 24.1 i) 2.1 ± .3**** ii) -.1 ± .3 i) 56.9 ± 13.4**** ii) 3.3 ± 13.8 i) -4.9 ± .4%**** ii) .1 ± .4% i) -108.5 ± 12.9**** ii) -11.2 ± 24.1	1 year	Prospective, longitudinal case-control study
Sarri et al. (2005)	Healthy Orthodox Christian adults from Crete, Greece i) 43.6 ± 13.2 ii) 39.8 ± 7.6	n = 59	i) Eastern Orthodox Christian fasting ii) Control – Non-fasters	1) Serum ferritin: (ng/mL): 2) Total iron-binding capacity (μmol/L):	i) 13.0 ± 65.1**** ii) 4.08 ± 49.9 i) -8.6 ± 6.9**** ii) 1.1 ± 5.1	40 days (Nativity fast)	Prospective, longitudinal case-control study
Sarri et al. (2007)	Healthy Orthodox Christian adults from Crete, Greece i) 41.3 ± 11.9 ii) 39.5 ± 11.3	n = 67	i) Eastern Orthodox Christian fasting ii) Control – Non-fasters	1) Systolic blood pressure (mmHg): 2) Diastolic blood pressure (mmHg):	i) -1.8 * ii) -3.89 i) 0.7 ** ii) -2.3	1 year	Prospective, longitudinal case-control study
Sarri et al. (2008)	Healthy Orthodox Christian adults from Crete, Greece i) 42.2 ± 9.7 ii) 39.5 ± 8.9	n = 51	i) Eastern Orthodox Christian fasting ii) Control – Non-fasters	1) Adipose DHA (c22:6n-3) (g/100): 2) Depression (BDI):	i) .18 ± .05** ii) .15 ± .02 i) -8.4 ± 4.5* ii) 6.3 ± 5.6	1 year	Prospective, longitudinal case-control study
Papadaki et al. (2008)	Healthy Orthodox Christian adult male monks from Crete, Greece 25-65	n = 10	i) Eastern Orthodox Christian fasting period ii) Control – Self-referential during non-fasting period	1) Systolic blood pressure (mmHg): 2) Serum total cholesterol (mg/dL): 3) Serum LDL cholesterol (mg/dL): 4) Serum triglycerides (mg/dL): 5) Dietary fiber (g): 6) Dietary calcium (mg):	i) 124 ± 12.5** ii) 116 ± 13.9 i) 161 ± 29.6*** ii) 196 ± 43.1 i) 91.9 ± 27.0*** ii) 134 ± 28.4 i) 149 ± 73.8* ii) 99.1 ± 43.6 i) 27.7 ± 8.0**** ii) 13.8 ± 2.8 i) 429 ± 96** ii) 702 ± 305	2 weeks (1-week fasting, 1-week non-fasting)	Single-arm, prospective case study
Sarri et al. (2009)	Healthy Orthodox Christian adults from Crete, Greece i) 43.0 ± 13.1 ii) 38.6 ± 9.6	n = 85	i) Eastern Orthodox Christian fasting ii) Control – Non-fasters	1) Serum retinol (μmol/L): 2) Serum α-tocopherol (μmol/L):	i) -.8 ± .6**** ii) .3 ± .7 i) -8.0 ± 6.6**** ii) .4 ± 4.8	40 days (Nativity fast)	Prospective, longitudinal case-control study
Liali et al. (2015)	Healthy Orthodox Christian adult female nuns from Thessaloniki, Greece 20-55	n = 41	i) Eastern Orthodox Christian fasting ii) Control – Self-referential pre-fasting baseline	1) Coagulation factor VII (%): 2) APTT ratio:	i) 91.97 ± 18.43**** ii) 107.82 ± 19.15 i) 0.91 ± .09**** ii) 1.04 ± .12	48 days (Great Lenten fast)	Single-arm case study

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Table 2 (Continued)

Elshorbagy et al. (2017)	Sedentary Orthodox Christian young adults from Alexandria, Egypt 31 ± 2 n = 36	i) Oriental Orthodox Christian fasting  ii) No control	1) Serum total cholesterol (mg/dL): 2) Serum LDL cholesterol (mg/dL): 3) Plasma leucine (%): 4) Plasma isoleucine (%): 5) Plasma valine (%):	-14 ± 5**** -13 ± 6**** -13**** -10*** -19****	6 weeks	Single-arm case study
Karras et al. (2017)	Healthy Orthodox Christian adult male monks from Mt. Athos, Greece 38.8 ± 9.7 n = 70	i) Eastern Orthodox Christian fasting, i.e., "restrictive" day (RD)  ii) Control – Self-referential during the non-fasting period, i.e., "non-restrictive" day (NRD)	1) Caloric intake (kcal): 2) Dietary fat (g): 3) Dietary vitamin D (% DRI): 4) Dietary calcium (mg): 5) Dietary magnesium (mg):	i) 1265.9 ± 84.5**** ii) 1660 ± 81.0  i) 30.0 ± .1 ii) 21.4 ± .6  i) 20.0 ± .0 ii) 19.8 ± .0  i) 57.9 ± .2 ii) 66.5 ± .2  i) 39.85 ± .7 ii) 36.26 ± .9	2 days	Prospective, cross-sectional study
Desalegn et al. (2018)	Lactating Orthodox Tewahedo Christian adult women from Tigray, Ethiopia N/A n = 572	i) Oriental Orthodox Christian faster during Great Lent (OF-L)  ii) Non-fasting mother during Great Lent (NF-L)  iii) OF – during the non-fasting period (OF-NF)  iv) NF – during non-fasting period (NF-NF)	1) Dietary diversity score:	i) 2.50 ± .54 ** ii) 2.63 ± .53 ** iii) 2.69 ± .58 iv) 2.73 ± .55	2 days	Longitudinal study
Kumera, Tsedal & Ayana (2018)	Orthodox Tewahedo Christian children from Dejen, Ethiopia 6-23 months n = 967	i) Eastern Orthodox Christian fasting mother  ii) No control	1) Dietary diversity score mean: 2) Dietary diversity score (<4) (%) a) Fasting: b) Economic status:	3.13 ± .87  54.8** 45.2	1 day	Prospective, cross-sectional study
Makedou et al. (2018)	Healthy Orthodox Christian adults from Thessaloniki, Greece 19-66 n = 35	i) Eastern Orthodox Christian fasting  ii) Control – Self-referential pre-fasting baseline	1) Plasma total antioxidant capacity (mmol/L): 2) Coagulation factor VII (%): 3) APTT ratio:	i) .98 ± .04** ii) .84 ± .24  i) 97.7 ± 19.4*** ii) 104.8 ± 18.9  i) .91 ± .096**** ii) 1.07 ± .097	48 days (Great Lenten fast)	Single-arm case study
Desalegn et al. (2019)	Orthodox Tewahedo Christian children from Tigray, Ethiopia 6-23 months n = 567	i) Eastern Orthodox Christian fasting mother  ii) Non-fasting mother	1) Weight-for-age: 2) Height-for age:	i) -1.25 ± 1.15**** ii) .77 ± 1.09  i) -1.60 ± 1.35 *** ii) -1.24 ± 1.34	2 days	Longitudinal study

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Table 2 (Continued)

Karras et al. (2019)	Healthy Orthodox Christian adult male laymen and monks from Mt. Athos, Greece 20-45 n = 100	i) Athonian monks (AM) Eastern Orthodox Christian fasting, i.e., "restrictive" day (RD)	1) Dietary fat (g):	i) 30.07 ± .18**** ii) 54.94 ± 26.92 iii) 21.47 ± 1.96**** iv) 104.59 ± 9.27	2 days	Prospective, cross- sectional study
		ii) General population fasting (GF), RD	2) Serum triglycerides (mg/dL):	i) 73.82 ± 31.68**** ii) 113.22 ± 79.09		
		iii) AM during the non- fasting period, i.e., "non- restrictive" day (NRD)	3) Serum insulin: (µg/mL):	i) 4.61 ± 3.16**** ii) 11.64 ± 9.21		
			4) Serum glucose (mmol/L):	i) 4.71 ± .60**** ii) 5.12 ± .32		
			5) Insulin resistance (mmol/L):	i) 98 ± .72**** ii) 2.67 ± 2.19		
			6) Serum vitamin D (ng/mL)	i) 9.27 ± 5.81**** ii) 28.26 ± 39.66		
		iv) GF-NRD				

\*  $p > 0.05$

\*\*  $p < 0.05$

\*\*\*  $p < 0.01$

\*\*\*\*  $p < 0.001$

AM, Athonian monks; APTT, activated partial thromboplastin time; BDI, Beck Depression Inventory; DHA, docosahexaenoic acid; DRI, Dietary Reference Intake, GF, general population fasting, NRD, non-restrictive day; RD, restrictive day

Table 3.  
*Islamic Ramadan Fasting – PICOTS table*

Author(s)	Population		Group	Outcome(s)		Timing	Study Type
	Age (years)	Sample Size		Study Criteria	Study Result		
Awwad et al. (2012)	Pregnant Muslim adult women from Beirut, Lebanon i) 29.7 ± 5.2 ii) 30.0 ± 5.4	n = 468	i) Ramadan fasting –Fasting from sunrise to sunset ii) Control – Non-fasters	1) Preterm birth (%): 2) Newborn birth weight (g):	i) 11.9* ii) 10.9 i) 3094 ± 467** ii) 3202 ± 473	–	Prospective cohort study
Mesci et al. (2012)	Healthy Muslim adults from Istanbul, Turkey 33.31 ± 8.70	n = 42	i) Ramadan fasting –Fasting from sunrise to sunset ii) Control – Self-referential post-fasting	1) Serum adiponectin: (ng/mL): 2) Serum leptin: (ng/mL): 3) Serum ghrelin: (ng/mL):	i) 485.19 ± 893.12* ii) 286.52 ± 401.80 i) 12.25 ± 12.27* ii) 11.56 ± 12.27 i) 15.18 ± 19.82* ii) 24.07 ± 33.66	2 weeks	Prospective observational study
Nematy et al. (2012)	Muslim adults with ≥ 1 cardiovascular risk factor from Mashhad, Iran 54 ± 10	n = 82	i) Ramadan fasting –Fasting from sunrise to sunset ii) Control – Self-referential pre-fasting baseline	1) Coronary heart disease risk score: 2) Total cholesterol (mg/dL): 3) LDL cholesterol (mg/dL): 4) Triglycerides (mg/dL): 5) Systolic blood pressure (mmHg):	i) 10.8 ± 7**** ii) 13.0 ± 8 i) 184.3 ± 42** ii) 193.4 ± 51 i) 96.83 ± 35**** ii) 109.96 ± 46 i) 182.9 ± 112**** ii) 224.8 ± 129 i) 129.9 ± 17** ii) 132.9 ± 16	6 weeks	Prospective observational study
Norouzy et al. (2013)	Healthy Muslim adults from Mashhad, Iran i) 40.1 ± 0.7	n = 240	i) Ramadan fasting –Fasting from sunrise to sunset ii) Control –Self-referential pre-fasting baseline	1) Body weight (%): a) Men (≤35 y): b) Women (≤35 y): c) Men (36-70 y): d) Women (36-70 y): 2) Body fat (%): a) Men (≤35 y): b) Women (≤35 y): c) Men (36-70 y): d) Women (36-70 y):	-2.2 ± 2.2**** -1.4 ± 2.8**** -1.5 ± 1.3**** -0.8 ± 2.9**** -2.5 ± 3.2** -1.1 ± 2.8* -1.1 ± 1.5** -1.4 ± 2.8*	6 weeks	Prospective observational study
Ajabnoor et al. (2014)	Healthy Muslim young adults from Jeddah, Saudi Arabia 23.16 ± 1.2	n = 23	i) Ramadan fasting –Fasting from sunrise to sunset ii) Control –Self-referential pre-fasting baseline	1) Serum adiponectin: (morning) (μmol/mL): 2) Serum leptin: (morning) (ng/mL): 3) Insulin resistance (morning):	i) 8.80 ± 2.85**** ii) 11.62 ± .80 i) 16.36 ± 4.35**** ii) 7.07 ± 2.27 i) 4.51 ± 1.04*** ii) 1.98 ± .24	3 weeks	Prospective observational study
Al-Shafei et al. (2014)	Hypertensive and healthy Muslim adults from Benha, Egypt 55 ± 5	n = 80	i) Ramadan fasting –Fasting from sunrise to sunset in hypertensives ii) Control – Ramadan fasting in sex- and age-matched normotensives	1) Arterial pulse pressure (%): 2) Systolic blood pressure (%): 3) Serum triglycerides (%): 4) HDL cholesterol (%): 5) LDL cholesterol (%): 6) Blood glutathione (%):	i) -17.5** ii) -9.3* i) -10.5** ii) -6.3* i) -24.5** ii) -22.8** i) 33.3** ii) 6.7* i) -17.7** ii) -4.0* i) 56.8** ii) 52.6*	3 months	Prospective cohort study
Mousavi et al. (2014)	Muslim adults with coronary artery disease from Shahrud, Iran 61.5 ± 11.7	n = 148	i) Ramadan fasting –Fasting from sunrise to sunset ii) Control – Non-fasters	1) Chest pain incidence (%): 2) Chest pain and dyspnea (%):	i) 6.1* ii) 9.8 i) 6.2* ii) 13.4	3 months	Non-randomized, prospective, observational pilot study
Petherick, Tuffnell, & Wright (2014)	Pregnant Muslim adult women from Bradford, UK 24-33	n = 310	i) Ramadan fasting –Fasting from sunrise to sunset ii) Control – Non-fasters	1) Preterm birth (%): 2) Newborn birth weight (g):	i) 3.1* ii) 3.5 i) 3219.3 ± 534.4* ii) 3133 ± 467.4	–	Prospective cohort study

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Table 3 (Continued)

Gnanou et al. (2017)	Healthy Muslim adult males from Kuala Lumpur, Malaysia 19-23 n = 20	i) Ramadan fasting –Fasting from sunrise to sunset  ii) Control –Self-referential pre-fasting baseline	1) Body weight (%): 2) Body mass index (%): 3) Plasma glucose (%): 4) Plasma insulin (%): 5) Plasma adiponectin (%):	-2.4**** -5.5**** -12.3*** -52.8*** -45.6****	1 month	Single-arm prospective observational study
Alsubheen et al. (2017)	Healthy Muslim adult males from Newfoundland, Canada i) 32.2 ± 2.6 ii) 35.0 ± 3.5 n = 17	i) Ramadan fasting –Fasting from sunrise to sunset  ii) Control – Non-fasters	1) Body fat (%): 2) Systolic blood pressure (%): 3) Physical activity (step count): 4) Total energy expenditure (TEE) (kcal/d):	i) -2.7** ii) 4  i) -9.2** ii) -4.5  i) 6850 ± 2079** ii) 9685 ± 7126  i) 181 ± 121** ii) 286 ± 265	7 weeks	Prospective observational study
Lessan et al. (2018)	Healthy Muslim adult females from London, UK 19-52 n = 29	i) Ramadan fasting –Fasting from sunrise to sunset ii) Control – Self-referential post-fasting	1) Resting metabolic rate (RMR) (kcal/d): 2) Physical activity (step count): 3) Total energy expenditure (TEE) (kcal/d):	i) 1365.7 ± 230.2* ii) 1362.9 ± 273.6  i) 9950 ± 1152 **** ii) 11,353 ± 2054  i) 2224.1 ± 433.7* ii) 2121.0 ± 718.5	5 weeks	Prospective crossover study
Savitri et al. (2018)	Pregnant Muslim adult women from Jakarta, Indonesia Mean = 28 n = 1351	i) Ramadan fasting –Fasting from sunrise to sunset  ii) Control – Non-fasters	1) Newborn birth weight (g):	i) 3107.5 ± 545.7* ii) 3022.4 ± 545.7	–	Prospective cohort study
Alam et al. (2019)	Healthy Muslim adult men from Khyber Pakhtunkhwa, Pakistan 20-85 n = 78	i) Ramadan fasting –Fasting from sunrise to sunset  ii) Control –Self-referential pre-fasting baseline  iii) Post-Ramadan fasting	1) Weight loss (kg) 2) Systolic blood pressure (mmHg): 3) Diastolic blood pressure (mmHg): 4) Triglycerides: 5) Fasting glucose: 6) Leptin: 7) Plasma tumor necrosis factor α (TNF- α) (%): 8) C-reactive protein: (mg/L):	i) 63.7 ± 14.8**** ii) 67.5 ± 15.0 iii) 66.4 ± 14.8  i) 124.2 ± 22.9**** ii) 140.6 ± 25.9 iii) 130.0 ± 22.6  i) 102.9 ± 25.6**** ii) 107.6 ± 24.5 iii) 106.2 ± 24.8  decrease**** decrease**** decrease**  i) -26.3**** iii) -9.6***  i) 1.89 ± .25**** ii) 3.03 ± .84 iii) 3.14 ± .84	2 months	Open-label longitudinal follow-up cohort study
Beltaief et al. (2019)	Muslim adults with ≥ 2 cardiovascular risk factors from Monastir, Tunisia 59.8 ± 10.5 n = 517	i) Ramadan fasting –Fasting from sunrise to sunset  ii) Control –Self-referential pre-fasting baseline  iii) Post-Ramadan fasting	1) Blood glucose (mmol/L): 2) Total cholesterol (mmol/L): 3) Triglycerides (mmol/L): 4) Insulin: (μUI /L): 5) Hemoglobin A1c (diabetics only) (%):	i) 9.09 ± .35** ii) 8.25 ± .34 iii) 8.04 ± .31  i) 4.67 ± .1** ii) 4.55 ± .1** iii) 4.60 ± .1  i) 1.81 ± .11** ii) 1.58 ± .08** iii) 1.60 ± .09  i) 16.9 ± 10.4** ii) 12.7 ± 10.5** iii) 15.1 ± 10.4  i) 9.0 ± .4** ii) 7.6 ± .2	3 months	Single-arm, prospective observational study

# FASTING & PRAYER FOR MDOC

Table 3 (Continued)

Mushtaq et al. (2019)	Generally healthy Muslim men and women from Karachi, Pakistan 20-40 n = 110	i) Ramadan fasting –Fasting from sunrise to sunset  ii) Control –Self-referential pre-fasting baseline	1) Plasma adiponectin: (µg/mL): a) overweight men b) obese men  c) overweight women d) obese women  2) Plasma TNF-α (pg/mL):  b) obese men d) obese women	i) 18.90 ± 5.85** ii) 13.90 ± 5.04 i) 16.83 ± 4.68**** ii) 12.76 ± 2.48 i) 23.50 ± 6.32* ii) 18.00 ± 6.58 i) 17.3 ± 4.46*** ii) 14.06 ± 4.01       i) 30.20 ± 10.17** ii) 36.08 ± 9.30 i) 27.17 ± 7.34*** ii) 30.49 ± 7.98	1 month	Prospective, cross-sectional study
Safari, Piro, & Ahmad (2019)	Pregnant Muslim adult women from Erbil, Iraq 18-35 n = 301	i) Ramadan fasting –Fasting from sunrise to sunset  ii) Control – Non-fasters	1) Gestational diabetes (%):  2) Preterm birth (%):	i) 2.58** ii) 8   i) 4.51* ii) 3.42	–	Case-control study

\*  $p > 0.05$

\*\*  $p < 0.05$

\*\*\*  $p < 0.01$

\*\*\*\*  $p < 0.001$

RMR, resting metabolic rate; TEE, total energy expenditure, TNF-α, tumor necrosis factor-alpha



Table 4.

*Physiological Effects of Intermittent Fasting – PICOTS and Jadad Table*

Author(s)	Population		Group	Outcome(s)		Timing	Study Type + Jadad Score
	Age (years)	Sample Size		Study Criteria	Study Result		
Harvie et al. (2013)	Overweight women with familial breast cancer history from Manchester, UK 20-69	n = 115	i) Intermittent energy and carbohydrate restriction (IECR) – 25% energy reduction  ii) Intermittent energy and carbohydrate restriction + <i>ad libitum</i> protein and fat (IECR+PF)  iii) Daily energy restriction (DER) – 25% energy reduction	1) Body fat mass (kg):  2) Insulin resistance reduction:	i) -3.7 ± 1.2*** ii) -3.7 ± 1.1** iii) -2.0 ± 1.0  i) -.34 ± .42** ii) -.38 ± .37 iii) -.2 ± .42	3 months + 1-month follow-up	Randomized control trial 4
Headland, Clifton, & Keogh (2018)	Overweight and obese adults from Adelaide, Australia 18-72	n = 332	i) Week-on, week-off (WOWO) – 30% energy reduction  ii) 5:2 diet – 30% energy reduction  iii) Continuous energy restriction (CER) – 30% energy reduction	1) Weight loss (kg):	i) -5.1 ± 1.2 ii) -5.0 ± 1.4 iii) -6.6 ± 1.6*	1 year	Randomized control trial 3
Panizza et al. (2019)	Obese East Asian adults with elevated visceral adipose tissue (VAT) from Honolulu, Hawaii 33-55	n = 60	i) IER + Mediterranean (IER+MED) diet – 70% energy reduction for 2 consecutive days  ii) euenergetic, Dietary Approaches to Stop Hypertension (DASH) diet	1) Visceral adipose tissue (cm <sup>2</sup> ):  2) Total fat mass (kg):	i) -22.6 ± 3.6** ii) -10.7 ± 3.5  i) -3.3 ± .4*** ii) -1.6 ± .4	12 weeks	Randomized active comparator, pilot trial 4
Carter, Clifton & Keogh (2016)	Overweight and obese, T2DM adults from Adelaide, Australia 18+	n = 63	i) IER – 400-600 cal for 2 days, 5 days habitual eating  ii) CER – 1200-1500 cal intake every day	1) Hemoglobin A <sub>1c</sub> (%):  2) Body fat (%):	i) -.6 ± .8* ii) -.8 ± 1.0  i) -3.8 ± 2.7* ii) -4.0 ± 3.2	12 weeks	Randomized control pilot trial 3
Carter, Clifton & Keogh (2018)	Overweight and obese, T2DM adults from Adelaide, Australia 18+	n = 137	i) IER – 500-600 cal for 2 days, 5 days habitual eating  ii) CER – 1200-1500 cal intake every day	1) Hemoglobin A <sub>1c</sub> (%):  2) Body fat mass (kg):	i) -.3 ± .1* ii) -.5 ± .2  i) -4.7 ± 1.4* ii) -3.4 ± 1.2	1 year	Randomized control noninferiority trial 3
Antoni et al. (2014)	Overweight and obese adults from Surrey, UK 18-65	n = 27	i) IER – 75% energy reduction for 2 consecutive days  ii) CER – 600 cal reduction from estimated energy requirements	1) Systolic blood pressure (mmHg):	i) -6 ± 5** ii) -6.4 ± 5.8	Until 5% weight loss – 9 months max	Randomized control trial 4

# FASTING & PRAYER FOR MDOC

Table 4 (Continued)

Conley et al. (2018)	Obese, adult male war veterans from Melbourne, Australia 55-75 n = 24	i) 5:2 – 600 cal maximum on 2 fast days, <i>ad libitum</i> for 5 days  ii) Standard energy-restricted diet (SERD) – 500 cal reduction from average requirements	1) Weight loss (kg):  2) Waist circumference (cm):  3) Systolic blood pressure (mmHg):	i) -5.3 ± 3.0* ii) -5.4 ± 4.3  i) -8.0 ± 4.5* ii) -6.4 ± 5.8  i) -14* ii) -10.2	6 months	Randomized control pilot trial 5
Hirsh et al. (2019)	Overweight, but not obese adults from Fort Lauderdale, Florida 21-65 n = 22	i) 5:2 – 730 cal from shakes on 2 fast days, <i>habitual diet</i> for 5 days  ii) Control – Habitual diet + daily multivitamin	1) Body weight (kg):  2) Total cholesterol:HDL ratio:	i) -1.3 ± 1.1* ii) .4 ± .9  i) -.3 ± .2** ii) .02 ± .25	52 days	Randomized, control pilot trial 3
Varady et al. (2013)	Normal weight and overweight adults from Chicago, Illinois 25-65 n = 32	i) ADF - 75% energy reduction, with time-restricted eating, on "fast days," <i>ad libitum</i> on "feed days"  ii) Control – <i>ad libitum</i> every day	1) Body fat mass (kg):  2) LDL cholesterol (mg/dL):  3) Triglycerides (mg/dL):	i) -3.6 ± .7 ii) -.3 ± .5  i) -18 ± 6* ii) -9 ± 4  i) -22 ± 11* ii) 10 ± 7  i) 181 ± 121** ii) 286 ± 265	12 weeks	Randomized control, parallel-arm trial 3
Hoddy et al. (2014)	Obese adults from Chicago, Illinois  25-65 n = 74	i) ADF-lunch (ADF-L) – 75% energy reduction on "fast days" meals consumed between 12-2 PM, alternated with <i>ad libitum</i> on "feed days"  ii) ADF-dinner (ADF-D) – 75% energy reduction on "fast days" meals consumed between 6-8 PM, alternated with <i>ad libitum</i> on "feed days"  iii) ADF-small meals (ADF-SM) – 75% energy reduction on "fast days," divided into 3 small meals eaten in 3 windows, <i>ad libitum</i> on "feed days"	1) Body weight (kg):  2) Visceral fat mass (kg):  3) Systolic blood pressure (mmHg):	i) -3.5 ± .4**** ii) -4.1 ± .5 iii) -4.0 ± .5  i) -.075 ± .027**** ii) -.135 ± .042 iii) -.135 ± .032  i) -2 ± 2* ii) -5 ± 3 iii) -6 ± 3**	8 weeks	Randomized control, parallel-arm trial 3

# FASTING & PRAYER FOR MDOC

Table 4 (Continued)

Trepanowski et al. (2017)	Obese adults from Chicago, Illinois 18-65 n = 100	i) ADF – Alternating days of “fasting” (75% energy reduction from estimated energy requirements) and “feasting” (125% intake from EER)  ii) DER – 25% energy reduction from EER  iii) Control – Maintained habitual dietary intake and physical activity levels	1) Body weight (%):  2) HDL cholesterol (%):	i) -6.0 ± 2.5 ii) -5.3 ± 2.3  i) 2.9 ± 7.1 ii) 1.9 ± 7.0	13 months	Randomized control trial 3
Catenacci et al. (2019)	Obese adults from Aurora, Colorado 18-55 n = 26	i) ADF – Zero caloric intake, alternated with provided meals based on EER, supplemented by 5-7 <i>ad libitum</i> optional foods (total ~1400 calories excess)  ii) Caloric restriction (CR) – 400 cal daily energy reduction from EER	1) Weight loss (kg):  2) Relative weight change (%):  3) Triglycerides (mg/dL):	i) -8.2 ± .9* ii) -7.1 ± 1.0  i) -8.8 ± .9* ii) -6.2 ± .9  i) -25.0 ± 10.9** ii) -2.8 ± 11.3	8 weeks + 24-week follow-up	Randomized control, pilot trial 3
Moro et al. (2016)	Resistance-trained adult men from Veneto, Italy 25-35 n = 34	i) Time-restricted feeding (TRF) – 16 hour “fasting” window from 8 PM -1 PM, 100% of EER consumed in 3 meals during 8 hour “feeding” window  ii) Control – 100% of EER consumed in 3 meals	1) Body fat mass (%):  2) Fat-free mass (%):  3) Testosterone:	i) -16.4** ii) -2.8  i) .86 ii) .64  i) ****, **	8 weeks	Randomized control trial 3
Tinsley et al. (2017)	Recreationally active adult men from Lubbock, Texas 18-30 n = 28	TRF – <i>Ad libitum</i> diet on 3 days of resistance training, 4-hour “feeding” window on 4 non-resistance training days ii) Normal diet – Habitual eating patterns + 3 days of resistance training per week	1) Body fat mass (kg):  2) Fat-free mass (kg):  3) Bench press repetitions:	i) -.2 (d = -.07) ii) .8 (d = .18)  i) -.2 (d = -.02) ii) 2.3 (d = .25)  i) 1 (d = .39) ii) 1 (d = -.33)	8 weeks	Randomized control trial 3
Gabel et al. (2018)	Obese adults from Chicago, Illinois 25-65 n = 23	i) TRF – 8-hour “feeding” window, 18 hour “fasting” window ii) Control – Historic control group from a previous weight-loss trial, maintained habitual diet and physical activity	1) Relative weight loss (%):  2) Relative systolic blood pressure (%):	i) -2.6 ± -.5**** ii) N/A  i) -7 ± 2* ii) N/A	12 weeks	Pilot trial 3

# FASTING & PRAYER FOR MDOC

Table 4 (Continued)

Anton et al. (2018)	Sedentary, overweight and obese adults from Gainesville, Florida ≥65 n = 10	i) TRF – 8-hour <i>ad libitum</i> “feeding” window, 16 hour “fasting” window	1) Relative body weight (kg):	i) -2.6 ± -.5***	4 weeks	Single-arm pilot trial 1
Tinsley et al. (2019)	Healthy, active women from Lubbock, Texas 18-30 n = 40	ii) No control i) TRF – <i>Ad libitum diet</i> on 3 days of resistance training, 8-hour “feeding” window on 4 non-resistance training days, between 12-8 PM + masked placebo capsules ii) TRF + HMB – Same diet as TRF, but receiving 3 g/day β-hydroxy β-methylbutyrate (HMB) supplement iii) Control – Breakfast consumed as soon as possible after awakening, followed by self-selected eating intervals + masked placebo (calcium lactate) capsules	1) Body fat mass (kg): a) Intention to Treat (ITT): b) Per protocol (PP): 2) Fat-free mass (kg) (PP): 3) Bench press repetitions:	i) -2 ( <i>d</i> = -.08) ii) -4 ( <i>d</i> = -.13) iii) 2 ( <i>d</i> = .08) i) -4 ( <i>d</i> = .13) ii) -7 ( <i>d</i> = -.23) iii) 2 ( <i>d</i> = -.06)** i) 2 ( <i>d</i> = -.23) ii) 3 ( <i>d</i> = .32) iii) 2 ( <i>d</i> = .25) i) 1 ( <i>d</i> = .39) ii) 1 ( <i>d</i> = .18)	8 weeks	Randomized, placebo-controlled, blinded study 5

\* *p* > 0.05

\*\* *p* < 0.05

\*\*\* *p* < 0.01

\*\*\*\* *p* < 0.001

ADF, alternate day fasting; BP, blood pressure; DASH, Dietary Approaches to Stop Hypertension; CER, continuous energy restriction; CR, caloric restriction; DER, daily energy restriction; EER, estimated energy requirements; HbA<sub>1c</sub>, hemoglobin A<sub>1c</sub>; HMB, β-hydroxy β-methylbutyrate; IECR, intermittent energy and carbohydrate restriction; IER, intermittent energy restriction; ITT, intention-to-treat; PF, *ad libitum* protein and fat; PP, per protocol; SERD, standard energy-restricted diet; T2DM, type 2 diabetes mellitus

# FASTING & PRAYER FOR MDOC

**Table 5.**  
***Psychological Effects of Intermittent Fasting – PICOTS Table***

Author(s)	Population		Group	Outcome(s)		Timing	Study Type
	Age (years)	Sample Size		Study Criteria	Study Result		
Teng et al. (2011)	Healthy normal and overweight Muslim men from Kuala Lumpur, Malaysia 50-70	n = 25	i) Fasting and calorie restriction (FCR) – Muslim sunnah time-restricted fasting 2 days per week, plus 300-500 cal daily reduction from of EER  ii) Control – Maintained habitual diet and lifestyle	1) Body fat mass (%):  2) Vitality:	i) 6.4*** ii) 2.7  i) 8.7** ii) 5.9	3 months	Randomized control trial
Hussin et al. (2013)	Healthy normal and overweight Muslim men from Kuala Lumpur, Malaysia 50-70	n = 32	i) Fasting and calorie restriction (FCR) –Muslim sunnah time-restricted fasting 2 days per week, plus 300-500 cal daily reduction from of EER  ii) Control – Maintained habitual diet and lifestyle	1) Body fat mass (%):  2) Confusion:  3) Total mood disturbance:	i) -5.7**** ii) 1.1  i) -29.9** ii) -1.4  i) -51.7** ii) 7	3 months	Randomized control trial
Bastani, Rajabi, & Kianimarkani (2017)	Muslim adults with ≥ 1 cardiovascular risk factor from Mashhad, Iran 38 ± 3	n = 29	i) Ramadan fasting – Full abstinence from food from sundown to sunset  ii) Self-referential control – Results obtained from 2 days before Ramadan fast	1) Serotonin (Δ%): 2) BDNF (Δ%) 3) Dopamine (Δ%):	43.1** 46.9** 7.5*	1 month	Single-arm clinical trial
Koushali et al. (2013)	Healthy adult Muslim nurses from Tehran, Iran 37.82 ± 7.17	n = 313	i) Ramadan fasting – Fasting from sunrise to sunset ii) No control	1) Anxiety (%): 2) Stress (%): 3) Depression (%):	-3.2* -33** -26.7**	6-8 weeks	Descriptive analytical study
Ghayour Najafabadi et al. (2015)	Elite female athletes from Tehran, Iran 13-24	n = 17	i) Ramadan fasting –Fasting from sunrise to sunset  ii) No control	1) Task error rate (%):	i) -53.4** ii) -18.5	6 weeks	Prospective observational study
Ghazi et al. (2018)	Healthy adults from Mansoura, Egypt ≥ 60	n = 182	i) Ramadan fasting – Fasting from sunrise to sunset  ii) No control	1) Anxiety & Insomnia (%): 2) Depression (%):	-54.3**** -36.1****	6-8 weeks	Descriptive analytical study
Lieberman et al. (2008)	Healthy adults from Natick, Massachusetts 23.6 ± 1.0	n = 27	i) 48 hour fast – Placebo gel, + nonnutritive "foods" and <i>ad libitum</i> water  ii) Carb – Taste matched carbohydrate-dense gel  iii) Carb + Fat – Taste matched carbohydrate- and fat-dense gel	1) Satiety: 2) Depression:	d = .196**** d = .036*	2 days	Double-blind, placebo-controlled single-arm crossover trial

# FASTING & PRAYER FOR MDOC

Table 5 (Continued)

Solianiik et al. (2016)	Healthy, resistance-trained men from Kaunas, Lithuania 20-30 n = 9	i) 48 hour fast – Complete abstinence from caloric intake for 48 hours, <i>ad libitum</i> water intake  ii) Self-referential control – Baseline results before fast	1) Cognitive flexibility:  2) Anger:	$d = .98^{***}$  $d = 1.09^{**}$	4 days	Single-arm clinical trial
Giles et al. (2019)	Healthy adults from Natick, Massachusetts 18-25 n = 23	i) 48 hour fast – Placebo gel, plus nonnutritive "foods" and <i>ad libitum</i> water  ii) Self-referential control – Taste matched carbohydrate-dense hydrocolloid gel	1) Anger:  2) Depression:  3) Confusion:	$^{***}$ $^{****}$ $^{****}$	12 days	Randomized double-blind, placebo-controlled crossover trial
Watkins & Serpell (2016)	Healthy women from London, UK 18-56 n = 52	i) Time-restricted feeding (TRF) – Single 18-hour fasting period  ii) Control – Single 18-hour non-fasting period	1) Irritability:  2) Sense of achievement:  3) Sense of pride:	$-16.4^{***}$ $.86^{***}$ $^{***}$	9 days	Randomized crossover trial

\*  $p > 0.05$

\*\*  $p < 0.05$

\*\*\*  $p < 0.01$

\*\*\*\*  $p < 0.001$

BDNF, BDNF: brain-derived neurotrophic factor; EER, estimated energy requirements; FCR, fasting and calorie restriction; TRF, time-restricted feeding

**Research Question 2: Assessment of the Empirical Efficacy of Psychosomatic Prayer and/or Meditation in the Improvement of Cardiometabolic and “Mental” Health**

Similar to fasting, there is considerable variation in the methods and purpose of prayer and meditation, from both a religious and a secular perspective. However, on the physiological level, it has been well established that these practices are beneficial for stress reduction, principally through improvements to hypothalamic and neurotransmitter regulation (Garland, 2017; Househam et al., 2017). Moreover, they are associated with improvements to metabolic and cognitive function, likely through reductions to inflammation.

Additionally, yoga and meditation can improve self-regulation of both appetite and subsequent food intake. Analogous to the previously addressed fasting section, this is likely through the establishment of a *telos* that directs the individual towards *egkrateia*. Whereas most people are going through life on autopilot, those engaging in these practices are being more consciously aware of the transcendental. As a final note, the critical distinction is “what” that contemplative energy is being directed towards.

In terms of results, in a randomized control trial, *hesychastic* prayer was discovered to significantly reduce depression, anxiety, hostility, interpersonal sensitivity, obsessive compulsion, and somatic symptoms, as compared to a non-intervention control group (Stavros, 1998). Similarly, a recent single-arm case study found statistically significant decreases in phobic anxiety, interpersonal sensitivity, tension, and fatigue, as well as marginally significant reductions in depression and anger, following the use of *hesychastic* prayer (Rubinart, Fornieles, & Deus, 2017). Several other case studies have

demonstrated comparable statistically significant reductions in depression, anxiety (Di Leo, 2007; Vujisic, 2009).

Ferguson, Willemsen, & Castañeto: (2010) found centering prayer, including the Jesus Prayer, to significantly reduce anxiety and increase the collaborative style of coping with stress. Another case study that utilized providence-focused therapy and included the Jesus Prayer in its methodology demonstrated statistically significant reductions in worry, depression, anxiety, and intolerance of uncertainty (Knabb, Frederick, & Cumming, 2017). A later randomized control trial by the same research group administered instruction in the Jesus Prayer through an online delivery format which also found statistically significant improvements to perceived stress and the surrender style of coping with stress (Knabb & Vazquez, 2018).

Pal et al. (2011) found yoga to be effective at statistically significantly decreasing systolic blood pressure, diastolic blood pressure, total cholesterol, HDL cholesterol, LDL cholesterol, and triglycerides. A later trial by the same researcher confirmed these results, demonstrating statistically significant reductions in heart rate, systolic and diastolic blood pressure (Pal et al., 2013). Similarly, another single-blind randomized control trial on yoga for coronary artery patients discovered statistically significant improvements to heart rate, systolic and diastolic blood pressure, slow vital capacity, and forced vital capacity (Yadav et al., 2015). Sreedevi et al. (2017) found that yoga can significantly reduce systolic blood pressure, and non-significantly reduce hemoglobin A<sub>1c</sub>.

In a meta-analysis of 32 randomized control trials, yoga was able to demonstrate statistically significant decreases in systolic and diastolic blood pressure, total



cholesterol, HDL and LDL cholesterol, triglycerides, BMI, body weight, and heart rate, as well as nonsignificant decreases to fasting blood sugar and hemoglobin A<sub>1c</sub> (Chu et al., 2016). Raghuram et al. (2014) also demonstrated that there were statistically significant reductions to stress, depression, anxiety, triglycerides, HDL cholesterol, LDL cholesterol, VLDL cholesterol, BMI, and fasting blood sugar, from yoga practice. Another randomized control trial compared yoga with dietary intervention to a dietary only intervention that established statistically significant changes to adiponectin, leptin, interleukin-6, superoxide dismutase, 8-hydroxy-2'-deoxyguanosine, thiobarbituric acid reactive substances, body weight, and waist circumference (Yadav et al., 2018).

A pair of single-blind randomized control trials on yoga in coal miners with COPD found statistically significant improvements to COPD assessment, dyspnea, oxygen saturation, fatigue, depression, and anxiety (Ranjita & Badhai et al., 2016; Ranjita & Hankey et al., 2016). Similarly, another double-blind, randomized control trial on individuals with COPD showed yoga to significantly increase endurance capacity and quality of life (Kaminsky et al., 2017).

Telles et al. (2010) demonstrated that yoga is associated with statistically significant reductions in anxiety and sadness. Another randomized control trial found yoga to significantly improve stress, anxiety, and quality of life (Köhn et al., 2013). Thirthalli et al. (2013) also found statistically lower depression and cortisol levels through the use of yoga practice, as compared to the control group. Similarly, a pilot trial comparing yoga to health classes discovered statistically significant reductions to depression and ruminations (Kinser, Elswick, & Kornstein, 2013). A long-term 5-year study showed yoga to be statistically significant at improving stress and negative affect,

as well as having a marginally significant effect on the overall quality of life in the mental health domain: (Amaravathi et al., 2018). Several other studies have also found statistically significant decreases in PTSD, depression, anxiety, fatigue, stress, as well as increased resilience, general self-efficacy and general health (van der Kolk et al., 2014; Jindani, Turner, & Khalsa, 2015; Bidgoli et al., 2016; Razazian et al., 2016; Hewett et al., 2018).

Paul-Labrador et al. (2006) found meditation to significantly reduce systolic blood pressure, mean arterial blood pressure, and insulin resistance, as well as resulting in marginally significant increases to heart rate variability. Another randomized control trial discovered meditation to significantly improve triglycerides and metabolic syndrome score (Vaccarino et al., 2013). Similarly, meditation significantly reduced fasting blood glucose, fasting serum insulin, and hemoglobin A1c (Sinha et al., 2018). Lee et al. (2019) also recently determined that meditation was efficacious at statistically significantly reducing LDL cholesterol.

Nidich et al. (2009) demonstrated statistically significant reductions to systolic and diastolic blood pressure in the hypertensive subgroup, as well as distress, anxiety, and depression in their meditation group, as compared to the non-meditative control arm. Another randomized control trial found meditation to significantly improve stress, sleep quality, mindfulness, and self-compassion. Basso et al. (2019) established meditative practice delivered in an online format was effective at statistically significantly improving mood and reducing fatigue, as well as non-significantly reducing anxiety. An additional randomized control trial determined that meditation was associated with statistically significant decreases in PTSD and insomnia (Bormann et al., 2018).

Daubenmier et al. (2016) determined statistically significant reductions in fasting blood glucose and triglycerides/HDL ratio, as well as nonsignificant decreases in weight loss, in an MBSR intervention as compared to a CBT control. In a randomized control trial, MBSR statistically significantly decreased systolic blood pressure and marginally significantly increased exercise capacity (Gotink et al., 2017). Another randomized control trial found a statistically significant reduction in systolic blood pressure, perceived stress, and state anger in cardiovascular disease patients, using MBSR versus treatment as usual (Momeni et al., 2016). López-Alarcón et al. (2020) demonstrated that MBSR could statistically significantly reduce serum ghrelin, serum cortisol, and anxiety.

Shomaker & Berman et al. (2017) established MBSR as statistically significant at improving food reward sensitivity and stress eating. In a pair of studies by the same researchers, MBSR was effective at statistically significantly decreasing insulin resistance, fasting serum insulin, and depression, as compared to CBT (Shomaker et al., 2017; Shomaker & Pivarunas et al., 2019).

Barrett et al. (2012) found that MBSR was associated with statistically significant reductions in acute respiratory infection incidence, illness length, and symptom severity. Unfortunately, in a follow-up randomized control trial, by the same researchers, MBSR did not reach statistically significant differences from the control group (Barrett et al., 2018). However, when a multivariate zero-inflated regression model was applied, incidence and symptom severity did significantly decrease (Barrett et al., 2018).

Lengacher et al. (2016) showed MBSR might statistically significantly reduce depression, anxiety, fear of relapse, fatigue severity and interference, as well as improve quality of life in breast cancer survivors, as compared to the control group. Similarly,

another randomized control trial with breast cancer survivors found MBSR to lead to statistically significant improvements in depression, psychological symptoms, global distress, mental health, coping capacity, personal growth, and natural killer cells (Kenne Sarenmalm et al., 2017). Another randomized control trial with breast cancer survivors demonstrated MBSR efficacious at improving the psychological and fatigue symptom clusters (Reich et al., 2017).

Brewer et al. (2009) demonstrated that MBSR was effective at statistically significantly reducing anxiety, as well as halving the incidence of stress-induced drug craving, as compared to standard CBT. In a randomized control pilot trial, MBSR was associated with statistically significant improvements to anxiety, external-based eating, and the observational and awareness domains of mindfulness (Daubenmier et al., 2011). Another randomized control trial determined MBSR induced statistically significant reductions to fear of emotional control, anger expression, and emotional stability, as well as highly significant improvements to mindfulness (Robins et al., 2012). Similarly, MBSR has been found to statistically significantly increase physical and mental quality of life, as well as significantly decrease stress, anxiety, and depressive symptoms (van Son et al., 2013).

Tang, Poon, & Kwan (2015) demonstrated MBSR to be efficacious at statistically significantly reducing depression, anxiety, while also significantly increasing the quality of life, cognitive effect, and cognitive function. In a non-randomized control trial with pregnant women, MBSR was discovered to significantly decrease perceived stress and depressive symptoms (Epel et al., 2019). A randomized control trial with veterans found MBSR to significantly improve PTSD, quality of life, and mindfulness (Polusny et al.,

2015). Several other randomized control trials have also established MBSR statistically significant at improving depression, anxiety, stress, overall quality of life and specifically in the mental health domain: (Huijbers et al., 2015; Jalali et al., 2019; Elimimian et al., 2020)

Zernicke et al. (2013) examined individuals with IBS and determined that MBSR was associated with statistically significant improvements in symptom severity, quality of life, mood, stress, and sense of purpose. Another recent randomized control trial on individuals with fibromyalgia established MBSR to significantly improve mental health, resilience, positive affect, and satisfaction with life (Cejudo et al., 2019).

Segal et al. (2010) found MBSR to have an equivalent hazard ratio for depression relapse, as standard pharmacological anti-depressant interventions. Conversely, another randomized control trial did not see statistically significant improvements with MBSR for depression relapse; however, when a hazard ratio was established for a subpopulation that experienced childhood trauma, significance was reached (Williams et al., 2014).

Similarly, Kuyken et al. (2015) found non-significant reductions in depression with MBSR, which reached significance when the childhood trauma subgroup became the focus. Collectively, these findings help to demonstrate the importance of the establishment of a *telos*, or sense of purpose, when dealing with traumatic events.

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Table 6.  
*Hesychasm – PICOTS Table*

Author(s)	Population		Group	Outcome(s)		Timing	Study Type
	Age (years)	Sample Size		Study Criteria	Study Result		
Stavros (1998)	Greek Orthodox Christian adults from throughout the United States 25-74	n = 88	i) Hesychasm – Jesus Prayer practice for 10 minutes, daily  ii) Control – No intervention	1) Depression (SCL 90-R): a) Before: b) After:  2) Anxiety (SCL 90-R): a) Before: b) After:  3) Hostility (SCL 90-R): a) Before: b) After:  4) Interpersonal sensitivity (SCL 90-R): a) Before: b) After:  5) Obsessive-compulsion (SCL 90-R): a) Before: b) After:  6) Somatic symptoms (SCL 90-R): a) Before: b) After:	i) .78*** ii) .43 i) .61 ii) .64  i) .41*** ii) .24 i) .40 ii) .42  i) .56** ii) .37 i) .58 ii) .53  i) .72*** ii) .41 i) .62 ii) .60  i) .82**** ii) .50 i) .64 ii) .77  i) .40** ii) .29 i) .46 ii) .41	1 month	Randomized control trial
Di Leo et al. (2007)	Orthodox Christian adults with a history of depression from Puerto Rico 45.6 ± 5.47	n = 15	i) Hesychasm – Jesus Prayer practice protocol + at-home practice, daily  ii) Self-referential control – post protocol	1) Depression (BDI):	i) 23.1 ± 4.32*** ii) 7.5 ± 2.45  i) -29.9** ii) -1.4  i) -51.7** ii) 7	6 months	Single-arm case study
Vujisic (2009)	Adults with a history of depression and anxiety from South Africa 23.9 ± 4.88	n = 15	i) Hesychasm – Jesus Prayer practice Protocol + Orthodox Christian fasting  ii) Self-referential control – post protocol	1) Depression (BDI):  2) Anxiety (BAI):	i) 23.9 ± 4.18*** ii) 13.1 ± 4.89  i) 32.9 ± 5.72** ii) 18.2 ± 8.37	12 weeks	Single-arm case study
Ferguson, Willemssen, & Castañeto: (2010)	Roman Catholic adults from California 35+	n = 30	i) Centering prayer – Centering prayer, including the Jesus Prayer sessions (10 sessions) for 2 hours, weekly  ii) Control – No intervention	1) Collaborative style (RPSS): a) Before: b) After:  2) Anxiety (STAI): a) Before: b) After:	i) 27.60 ± 9.94**** ii) 31.73 ± 10.52 i) 26.87 ± 10.38* ii) 27.33 ± 10.10  i) 34.20 ± 9.99**** ii) 29.20 ± 5.94 i) 35.53 ± 7.49**** ii) 32.80 ± 7.02	10 weeks	Case-control study

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Table 6 (Continued)

Knabb, Frederick, & Cumming (2017)	Chronic-worrying adult Christians from California 50.85 ± 21.45 n = 13	i) Providence-focused therapy for recurrent worry (PFT-RW) – Contemplative prayer 2-hour sessions, (8 sessions) Including the Jesus Prayer weekly + at-home prayer for 20 minutes, twice daily  iii) Self-referential control – post protocol	1) Worry (PSWQ):  2) Intolerance of uncertainty (IUS):  3) Depression-Anxiety-Stress (DASS):	i) 62.77 ± 12.17*** ii) 47.31 ± 9.84  i) 79.15 ± 18.83*** ii) 59.31 ± 19.00  i) 25.85 ± 14.61*** ii) 12.15 ± 7.08	8 weeks	Single-arm case study
Rubinart, Fornieles, & Deus (2017)	Non-conventional Roman Catholic adults from Catalonia, Spain 47.6 ± 2.99 n = 10	i) Hesychasm Jesus Prayer instructional 3-hour sessions (4 sessions) + at-home practice for 15-25 minutes, daily  ii) Self-referential control – post protocol iii) Self-referential control – at follow-up	1) Phobic Anxiety (SCL-90-R):  2) Interpersonal sensitivity (SCL-90-R):  3) Tension (POMS):  4) Fatigue (POMS):  5) Depression (POMS):  6) Anger (POMS):	i) 62.78 ± 33.92** ii) 40.00 ± 35.62 iii) 37.56 ± 35.28  i) 76.89 ± 27.33*** ii) 58.22 ± 27.65 iii) 54.11 ± 27.52  i) 42.2 ± 10.42** ii) 33.6 ± 5.56  i) 57.4 ± 9.19**** ii) 43.5 ± 10.75  i) 45.8 ± 7.28* ii) 43.1 ± 5.17  i) 46.2 ± 7.11* ii) 42.2 ± 5.03	2 months + 5-month follow-up	Single-arm case study
Knabb & Vasquez (2018)	Adult Christians with daily stress from California 22.57 ± 5.32 n = 86	i) Hesychasm – Jesus Prayer instruction through online delivery + practice for 10 minutes, daily  ii) Control – Non-prayer waitlist	1) Perceived stress (PSS): a) Before: b) After:  2) Spiritual experience (DSE): a) Before: b) After:  3) Surrender (SS): a) Before: b) After:	i) 23.25 ± 5.65*** ii) 18.89 ± 5.95 i) 22.76 ± 7.22 ii) 21.98 ± 5.94  i) 63.41 ± 10.95* ii) 68.61 ± 11.01 i) 63.50 ± 12.62 ii) 67.64 ± 11.38  i) 42.93 ± 7.23*** ii) 46.55 ± 6.91 i) 44.10 ± 9.53 ii) 44.64 ± 8.86	2 weeks	Randomized control trial

\*  $p > 0.05$

\*\*  $p < 0.05$

\*\*\*  $p < 0.01$

\*\*\*\*  $p < 0.001$

BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; DASS21, Depression, Anxiety, and Stress Scale; DSE, Daily Spiritual Experience Scale; POMS, Intolerance of Uncertainty Scale; Profile of Mood States; PSS, Perceived Stress Scale; PSWQ, Penn State Worry Questionnaire; RPSS, Religious Problem-Solving Scale; SCL-90-R, Revised Symptom Checklist 90, SS, Surrender Scale; STAI, State-Trait Anxiety Inventory

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**Table 7.**  
***Yoga – PICOTS and Jadad Table***

Author(s)	Population		Group	Outcome(s)		Timing	Study Type + Jadad Score
	Age (years)	Sample Size		Study Criteria	Study Result		
Telles et al. (2010)	Healthy adult males from Bihar, India 31.5 ± 7.5	n = 22	i) Yoga – Yoga practice for 1 hour, daily  ii) Control – Non-yoga waitlist	1) Sadness (mm) (VAS): a) Before: b) After:  2) Anxiety (mm) (VAS): a) Before: b) After:	i) 7.12 ± 3.21** ii) 5.98 ± 3.58 i) 6.25 ± 5.07 ii) 5.07 ± 2.89  i) 5.72 ± 3.19 ii) 4.49 ± 2.64 i) 4.76 ± 2.69** ii) 4.88 ± 3.15	1 week	Randomized control trial 3
Pal et al. (2011)	Adults with coronary artery disease from Lucknow, India 35-82	n = 154	i) Yoga – Yoga practice for 35-40 minutes daily (5 days/week)  ii) Control – Non-yoga	1) Systolic blood pressure (mmHg):  2) Diastolic blood pressure (mmHg):  3) Total cholesterol (mg/dL):  4) HDL cholesterol (mg/dL):  5) LDL cholesterol (mg/dL):  6) Triglycerides (mg/dL):	i) 11.02 ± 9.46*** ii) 7.05 ± 6.29  i) 8.85 ± 7.92*** ii) 6.01 ± 4.98  i) 28.29 ± 30.86**** ii) 5.31 ± 40.93  i) 6.44 ± 4.92**** ii) 2.00 ± 6.88  i) 15.10 ± 45.23** ii) 1.09 ± 39.64  i) 38.04 ± 37.39**** ii) 7.33 ± 34.82	6 months	Randomized control trial 3
Köhn et al. (2013)	Adults with stress-related disorders from Örebro, Sweden 43 ± 12	n = 44	i) Yoga – Yoga practice for 1 hour, (1 day/week)  ii) Control – Non-yoga waitlist	1) Stress (PSS):  2) Anxiety (HADS-Anxiety):  3) Quality of life (EQ-VAS)	15.5 ± 7.5****  3.2 ± 2.4**  -13.6 ± 12.4**	12 weeks	Randomized control trial 4
Pal et al. (2013)	Adults with coronary artery disease from Lucknow, India 35-82	n = 258	i) Yoga – Yoga practice for 35-40 minutes daily (5 days/week)  ii) Control – Non-yoga	1) Systolic blood pressure (mmHg): a) Before: b) After:  2) Diastolic blood pressure (mmHg): a) Before: b) After:  3) Heart rate (beats/min): a) Before: b) After:	i) 130.1 ± 10.3*** ii) 129.8 ± 14.1 i) 123.1 ± 9.4 ii) 129.1 ± 9.3  i) 83.7 ± 8.0**** ii) 82.3 ± 8.6 i) 80.48 ± 5.12 ii) 83.8 ± 5.7  i) 73.0 ± 9.1**** ii) 71.6 ± 11.4 i) 70.5 ± 7.5 ii) 73.3 ± 8.7	18 months	Randomized control pilot trial 3
Thirthalli et al. (2013)	Depressed, non-suicidal adults from Bangalore, India i) 54.3 ± 8.6 ii) 34.0 ± 9.7	n = 54	i) Yoga – Yoga practice for 1 hour, daily  ii) Control – Medications  iii) Comparator – Yoga + medications	1) Depression (HDRS): a) Before: b) After:  2) Cortisol (ng/mL): a) Before: b) After:  3) Cortisol (all yoga) (ng/mL): a) Before: b) After:  4) Cortisol (medication only) (ng/mL): a) Before: b) After:	i) 17.8 ± 4.5**** i) 5.3 ± 5.0  i) 109.9 ± 63.8* ii) 97.99 ± 48.25  i+iii) 111.9 ± 58.4*** i+iii) 91.7 ± 47.3  ii) 95.7 ± 62.1* ii) 113.0 ± 48.5	3 months	Open-labeled, active-control trial 2
Kinser, Elswick, & Kornstein: (2014)	Depressed, non-suicidal adult females from Richmond, Virginia 43.3 ± 15.6 follow-up: 38.9 ± 12.6	n = 27 follow-up: n = 9	i) Yoga – Yoga practice for 75 minutes daily  ii) Control – Health education attention-control, with 75-minute weekly sessions	1) Depression (PHQ-9): a) Before: b) After:  c) Follow-up  2) Ruminations (RRS): a) Before: b) After:  c) Follow-up	i) 14.9 ± 1.3*** ii) 16.4 ± 1.5 i) 4.8 ± 1.4 ii) 14.4 ± 1.9 i) 6.8 ± 1.7 ii) 21.3 ± 2.8  i) 27.4 ± 1.6** ii) 24.9 ± 1.6 i) 20.6 ± 1.7 ii) 22.2 ± 2.3 i) 20.8 ± 1.8 ii) 29.7 ± 3.2	8 weeks + 1-year follow-up	Randomized control pilot trial 3



# FASTING & PRAYER FOR MDOC

**Table 7 (Continued)**

Raghuram et al. (2014)	Adult males, post-coronary artery surgery from Bengaluru, India 35-65 n = 250	i) Yoga – 30 minutes of yoga practice, daily  ii) Control – 30 minutes of breathing exercises and physical therapy, daily	1) Stress ( $\Delta\%$ ) (PSS): 2) Depression ( $\Delta\%$ ) (HADS): 3) Anxiety ( $\Delta\%$ ) (HADS): 4) Triglycerides ( $\Delta\%$ ): 5) HDL cholesterol ( $\Delta\%$ ) ( $< 35$ mg/dL): 6) LDL cholesterol ( $\Delta\%$ ) ( $\geq 100$ mg/dL): 7) VLDL cholesterol ( $\Delta\%$ ): 8) Body mass index ( $\Delta\%$ ): 9) Fasting blood sugar ( $\Delta\%$ ):	i) -14.94**** ii) 6.71*  i) -30.77**** ii) -14.66**  i) -27.03**** ii) -13.02***  i) -20.87**** ii) -17.02****  i) 25.68**** ii) 21.68**  i) -25.41*** ii) -9.18*  i) -18.35**** ii) -11.95**  i) -6.72**** ii) -1.15*  i) -2.79** ii) 2.41*	1 year	Prospective, single-blind, randomized control trial 5
van der Kolk et al. (2014)	Adult females with post-traumatic stress disorder (PTSD) from Boston, Massachusetts 18-58 n = 64	i) Yoga – Yoga class for 1 hour, weekly  ii) Control – Women's health education class for 1 hour, weekly	1) PTSD (CAPS): a) Before: b) After: 2) Depression (BDI): a) Before: b) After:	i) 65.27 $\pm$ 24.50**** ii) 73.06 $\pm$ 25.86 i) 51.49 $\pm$ 24.09 ii) 63.75 $\pm$ 28.81  i) 20.89 $\pm$ 11.13** ii) 24.06 $\pm$ 11.47**** i) 13.92 $\pm$ 9.91 ii) 19.47 $\pm$ 11.91	10 weeks	Randomized, control trial 4
Jindani, Turner, & Khalsa (2015)	Adults with post-traumatic stress disorder from Toronto, Canada 18-64 n = 80	i) Yoga – Yoga class for 90-minutes (1 day/week) + daily at-home practice for 15 minutes  ii) Control – Non-yoga waitlist	1) PTSD (PCL-17): a) Before: b) After: 2) Stress (PSS): a) Before: b) After: 3) Anxiety (DASS <sub>21</sub> ): a) Before: b) After: 4) Resilience (Resilience Scale): a) Before: b) After:	i) 59.5 $\pm$ 9.3** ii) 55.1 $\pm$ 11.9 i) 41.8 $\pm$ 12.0 ii) 55.4 $\pm$ 13.5  i) 24.9 $\pm$ 7.6** ii) 24.8 $\pm$ 7.2 i) 12.4 $\pm$ 11.4 ii) 21.6 $\pm$ 4.8  i) 9.4 $\pm$ 5.2** ii) 9.6 $\pm$ 5.4 i) 5.7 $\pm$ 4.3 ii) 7.8 $\pm$ 5.5  i) 112.4 $\pm$ 24.1** ii) 110.7 $\pm$ 25.8 i) 124.7 $\pm$ 23.2 ii) 111.1 $\pm$ 23.9	8 weeks	Randomized control, pilot trial 4
Yadav et al. (2015)	Adults with coronary artery disease years, from Delhi, India 45-65 n = 80	i) Yoga – Yoga practice for 1 hour, daily (6 days/week)  ii) Control – Medications	1) Slow vital capacity (L): a) Before: b) After: 2) Forced vital capacity (L): a) Before: b) After: 3) Systolic blood pressure (mmHg): a) Before: b) After: 4) Diastolic blood pressure (mmHg): a) Before: b) After: 5) Heart rate (beats/min) a) Before: b) After:	i) 1.870 $\pm$ .09**** ii) 1.453 $\pm$ .081 i) 2.185 $\pm$ .102 ii) 1.434 $\pm$ .055  i) 1.589 $\pm$ .08**** ii) 1.587 $\pm$ .102 i) 2.122 $\pm$ .115 ii) 1.567 $\pm$ .083  i) 142.8 $\pm$ 12.8** ii) 142.6 $\pm$ 4.6 i) 126.6 $\pm$ 14.2 ii) 132.63 $\pm$ 6.4  i) 84.4 $\pm$ 10.2** ii) 82.53 $\pm$ 4.6 i) 80.00 $\pm$ 8.4 ii) 80.2 $\pm$ 5.4  i) 88.5 $\pm$ 9.22** ii) 87.8 $\pm$ 8.54 i) 76.2 $\pm$ 8.51 ii) 83.6 $\pm$ 9.88	3 months	Prospective, single-blind, randomized control trial 4

Table 7 (Continued)

Bidgoli et al. (2016)	Adults with anxiety related to coronary angiography procedure from Kashan, Iran 45-70 n = 80	i) Yoga – pranayama breathing instruction for 5 minutes  ii) Control – Routine care, no breathing training	1) Anxiety (SAI): a) Before:  b) After:	i) 53.37**** ii) 54.27* i) 40.75 ii) 51.4	1 hour	Double-blind, randomized control pilot trial 5
Chu et al. (2016)	Adults within 32 randomized control trials N/A n = 2768	i) Yoga  ii) Control – non-exercise intervention	1) Systolic blood pressure (mmHg): 2) Diastolic blood pressure (mmHg): 3) Total cholesterol (mg/dL): 4) HDL cholesterol (mg/dL): 5) LDL cholesterol (mg/dL): 6) Triglycerides (mg/dL): 7) Body mass index (kg/m <sup>2</sup> ): 8) Body weight (kg): 9) Heart rate (beats/min): 10) Fasting blood sugar (mg/dL): 11) Hemoglobin A <sub>1c</sub> (%):	-5.21 ± 2.8**** -4.98 ± 2.19**** -18.48 ± 10.68**** 3.20 ± 1.34**** -12.14 ± 9.66*** -25.89 ± 10.29**** -.77 ± .32**** -2.35 ± 1.98** -5.27 ± 4.27** -5.91 ± 10.41* -.06 ± .18*	–	Meta-analysis of randomized control trials 4
Ranjita, Badhai et al. (2016)	Adult male coal miners with COPD from Odisha, India 36-60 n = 81	i) Yoga – Yoga practice for 90-minutes daily (6 days/week)  ii) Control – Non-yoga waitlist	1) COPD assessment test: a) Before: b) After: 2) Depression (BDI): a) Before: b) After: 3) Anxiety (STAI-total): a) Before: b) After:	i) 20.69 ± 5.53**** ii) 21.81 ± 5.48 i) 15.92 ± 6.51 ii) 22.36 ± 5.65  i) 22.25 ± 8.47**** ii) 24.14 ± 9.21 i) 16.56 ± 7.03 ii) 23.36 ± 10.49  i) 80.67 ± 16.06**** ii) 77.78 ± 19.27 i) 68.86 ± 17.96 ii) 79.26 ± 19.77	12 weeks	Single-blind, randomized control trial 5
Ranjita, Hankey et al. (2016)	Adult male coal miners with COPD from Odisha, India 36-60 n = 81	i) Yoga – Yoga practice for 90-minutes daily (6 days/week)  ii) Control – Non-yoga waitlist	1) Dyspnea (Borg scale): a) Before: b) After: 2) Fatigue (Borg scale): a) Before: b) After: 3) Oxygen saturation (S <sub>p</sub> O <sub>2</sub> %): a) Before: b) After:	i) 5.08 ± 1.40**** ii) 5.25 ± 1.61 i) 3.84 ± 1.75 ii) 4.93 ± 2.02  i) 4.91 ± 1.34**** ii) 3.64 ± 1.64 i) 4.78 ± 1.69 ii) 4.51 ± 1.68  i) 92.47 ± 1.87**** ii) 92.36 ± 1.58 i) 93.69 ± 2.47 ii) 92.58 ± 1.71	12 weeks	Single-blind, randomized control trial 5
Razazian et al. (2016)	Adult females with multiple sclerosis from Kermanshah, Iran 33.94 ± 6.92 n = 54	i) Yoga – Yoga practice for 1 hour (3 days/week)  ii) Control – non-exercise  iii) Comparator – Aquatic exercise for 1 hour (3 days/week)	1) Fatigue (FSS): a) Before:  b) After: 2) Depression (BDI): a) Before:  b) After:	i) 38.94 ± 13.63** ii) 39.56 ± 14.68 iii) 48.72 ± 11.46 i) 16.22 ± 9.60 ii) 41.22 ± 13.52 iii) 25.28 ± 11.71  i) 19.72 ± 7.04** ii) 20.78 ± 6.22 iii) 19.17 ± 7.83 i) 5.06 ± 2.92 ii) 21.33 ± 6.88 iii) 4.78 ± 3.42	8 weeks	Single-blind, randomized control-comparator trial 4

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Table 7 (Continued)

Kaminsky et al. (2017)	Adults with COPD from Burlington, Vermont and Houston, Texas 40-84 n = 43	i) Yoga – pranayama breathing learning and practice for 30 minutes and educational materials for 30 minutes during visits (2 days/week) + daily at-home practice for 30 minutes  ii) Control – Educational materials for 1 hour, during visits (2 days/week)	1) 6-minute walk distance (m):  2) Quality of life (SGRQ-C impact): a) Before: b) After:	i) 28 ± 33* ii) -15 ± 32  i) 31.0 ± 16.7** ii) 36.7 ± 21.4** i) 23.1 ± 9.9 ii) 34.8 ± 21.5	12 weeks	Double-blind, randomized control pilot trial 5
Sreedevi et al. (2017)	Adult females with T2DM from Kerala, India 30-65 n = 124	i) Yoga – Yoga practice for 1 hour (2 days/week)  ii) Control  iii) Comparator – Peer support for 1 hour (1 day/week)	1) Systolic blood pressure (Δ%):  2) Hemoglobin A <sub>1c</sub> (Δ%):	i) -4.52** ii) 2.54* iii) 1.88*  i) -2.08* ii) 2.13* iii) 5.37*	3 months	Open-label, randomized, triple-arm, control-comparator feasibility study 3
Amaravathi et al. (2018)	Adult males, post-coronary artery surgery from Bengaluru, India 35-65 n = 300	i) Yoga – Yoga practice for 90-minutes (3-5 days/week)  ii) Comparator – Conventional cardiac rehabilitation program	1) Stress (Δ%) (PSS):  2) Mental health (Δ%)  3) Negative affect (Δ%) (PANAS):	i) -17.96** ii) 12.13  i) 3.20* ii) -2.09  i) -7.30** ii) 30.70	5 years	Randomized control trial 3
Hewett et al. (2018)	Sedentary adults with stress-related disorders from Sydney, Australia 37 ± 10.8 n = 63	i) Yoga – Yoga practice for 90 minutes (3-5 days/week)  ii) Control – No-treatment	1) Stress (PSS): a) Before: b) After:  2) General self-efficacy (GSE): a) Before: b) After:  3) Energy/fatigue (SF-36): a) Before: b) After:  4) General health (SF-36): a) Before: b) After:	i) 20.7 ± 4.7*** ii) 21.3 ± 5.4 i) 12.9 ± 7.6 ii) 19.1 ± 6.6  i) 29.5 ± 4.4** ii) 29.3 ± 4.6 i) 32.6 ± 4.1 ii) 30.4 ± 4.6  i) 37.9 ± 16.3** ii) 37.9 ± 19.8 i) 54.5 ± 18.0 ii) 43.5 ± 15.9  i) 50.5 ± 18.9** ii) 47.2 ± 18.3 i) 65.5 ± 20.9 ii) 54.3 ± 20.2	16 weeks	Parallel-arm, randomized control trial 4

Table 7 (Continued)

Yadav et al. (2018)	Adults with metabolic syndrome from New Delhi, India 20-45 n = 265	i) Yoga – Yoga practice for 90-minutes, daily + dietary intervention  ii) Comparator – Dietary intervention, including: 50-60% carbs, <30% fat, 10-15% protein, 25-40g fiber, < 5g salt	1) Adiponectin: (Δ%):	i) 6.95%*** ii) -9.81*	12 weeks	Prospective, open-labelled, parallel-arm, randomized control trial 4
			2) Leptin: (Δ%):	i) -17.37**** ii) -2.49*		
			3) Interleukin-6 (%):	i) -35.34**** ii) -10.10*		
			4) Superoxide dismutase (Δ%):	i) 2.21** ii) 1.57*		
			5) TBARS (Δ%):	i) -30.66**** ii) 10.98*		
			6) 8-OHdG (Δ%):	i) -7.00** ii) 1.30*		
			7) Body weight (Δ%):	i) -2.89** ii) -1.88		
			8) Waist circumference (Δ%):	i) -3.05**** ii) -1.59		

\*  $p > 0.05$

\*\*  $p < 0.05$

\*\*\*  $p < 0.01$

\*\*\*\*  $p < 0.001$

8-OHdG, 8-hydroxy-2'-deoxyguanosine; BDI, Beck Depression Inventory; CAPS, Clinician-Administered PTSD Scale; COPD, chronic obstructive pulmonary disease; DASS21, Depression, Anxiety, and Stress Scale; EQ-VAS, Euro Quality of Life; FSS, Fatigue Severity Scale; GSE, General Self-Efficacy Scale; HADS, Hospital Anxiety and Depression Scale; HDRS, Hamilton Depression Rating Scale; PANAS, Positive and Negative Affect Scale; PHQ-9, Patient Health Questionnaire; PSS, Perceived Stress Scale; PTSD, post-traumatic stress disorder; RRS, Rumination Response Scale; SAI, Spielberger State Anxiety Inventory; SF-36, 36-Item Short-Form Health Survey; S<sub>2</sub>O<sub>2</sub>, peripheral capillary oxygen saturation; SPRQ-C, St. George Respiratory Questionnaire – COPD; STAI, State-Trait Anxiety Inventory; T2DM, type 2 diabetes mellitus; TBARS, thiobarbituric acid reactive substances; VAS, visual analog scale; WHO-QOL-D2, World Health Organization quality of life scale – Domain 2

Table 8.  
*Meditation – PICOTS and Jadad Table*

Author(s)	Population		Group	Outcome(s)		Timing	Study Type + Jadad Score
	Age (years)	Sample Size		Study Criteria	Study Result		
Paul-Labrador et al. (2006)	Adults with coronary heart disease from California 67.4 ± 9.7	n = 103	i) Meditation – Transcendental meditation classes (16 sessions) for 1.5 hours, with at-home practice, daily  ii) Health education classes (16 sessions) for 1.5 hours, with at-home practice, daily	1) Systolic blood pressure (mmHg): a) Before: b) After:  2) Mean arterial pressure (mmHg): a) Before: b) After:  3) Insulin resistance:  4) Heart rate variability – (Δ high-frequency power):	i) 126.4. ± 14.4** ii) 127.4 ± 15.5 i) 123.5. ± 14.9 ii) 130.5 ± 16.1  i) 90.3. ± 9.1** ii) 91.7 ± 9.5 i) 90.1. ± 9.0 ii) 94.5 ± 10.9  i) -.79. ± 2.04** ii) .60 ± 2.84  i) -.10 ± .17* ii) -.50 ± .17	16 weeks	Randomized control trial 4
Nidich et al. (2009)	Healthy adult college students from Washington, DC 25.5 ± 9.6	n = 298	i) Meditation – Transcendental meditation practice for 20 minutes, twice daily  ii) Control – Non-meditation waitlist	1) Systolic blood pressure (mmHg):  2) Diastolic blood pressure (mmHg):  3) Systolic blood pressure (mmHg) – (hypertension subgroup):  4) Systolic blood pressure (mmHg) – (hypertension subgroup):  5) Distress (POMS)  6) Anxiety (POMS)  7) Depression (POMS):	i) -2.0 ± 1.2* ii) .4 ± 1.1  i) -1.2 ± .9* ii) .5 ± .8  i) -5.0 ± 1.9** ii) 1.3 ± 1.7  i) -2.8 ± 1.4** ii) 1.2 ± 1.2  i) -18.9 ± 3.2*** ii) -6.1 ± 2.9  i) -3.7 ± .7*** ii) -1.0 ± .6  i) -5.2 ± 1.0** ii) -1.9 ± .6	3 months	Randomized control trial 4
Vaccarino et al. (2013)	Black adults with metabolic syndrome from Atlanta, Georgia 30-65	n = 68	i) Meditation – Consciously resting meditation (CRM) classes (21 sessions) for 1-1.5 hours, with 20 minutes practice, twice daily  ii) Control – Health education classes (21 sessions) for 1-1.5 hours, with 20 minutes application, twice daily	1) Triglycerides (mg/dL):  2) Metabolic syndrome score:	i) -14.35 ± 17.4** ii) 17.72 ± 17.91  i) -0.41 ± 0.48** ii) .25 ± .47	12 months	Randomized control trial 4
Greeson et al. (2014)	Healthy adult college students from North Carolina 25.4 ± 5.7	n = 90	i) Koru meditation – Koru meditation class for 75 minutes, weekly + daily practice of ≥ 10 minutes  ii) Control – Non-meditation waitlist	1) Stress (PSS):  2) Sleep quality (MOS SLP9):  3) Mindfulness (CAMS-R):  4) Self-compassion (SCS):	i) 3.62** ii) .71  i) 3.04** ii) .03  i) -6.60**** ii) .59  i) -.20**** ii) -6.38	4 weeks	Randomized control trial 4

# FASTING & PRAYER FOR MDOC

Table 8 (Continued)

Bormann et al. 2018	Adult war veterans with PTSD from California and Massachusetts 35-65 n = 173	i) Meditation – Mantram repetition sessions for 1 hour, weekly  ii) Control – Present-centered therapy sessions for 1 hour, weekly	1) PTSD (CAPS score): a) $\Delta$ between groups b) $\Delta$ follow-up  2) PTSD (PCL-M score): a) $\Delta$ between groups b) $\Delta$ follow-up  3) Insomnia (ISI score): a) $\Delta$ between groups b) $\Delta$ follow-up	-9.98 $\pm$ 6.02*** -9.34 $\pm$ 7.84**  -5.83 $\pm$ 4.10** -4.51 $\pm$ 5.21*  -4.13 $\pm$ 1.94*** -4.81 $\pm$ 2.51***	8 weeks + 8-week follow-up	Randomized control trial 4
Sinha et al. (2018)	Adults with coronary artery disease from New Delhi, India 30-70 n = 60	i) Meditation – Concentrative meditation practice ( $\geq 5$ days/week)  ii) Control – Non-meditation	1) Fasting blood glucose (mg/dL): a) Before: b) After:  2) Hemoglobin A <sub>1c</sub> : a) Before: b) After:  3) Fasting serum insulin: a) Before: b) After:	i) 97.2 $\pm$ 11.0*** ii) 95.4 $\pm$ 11.1* i) 91.9 $\pm$ 5.5 ii) 93.3 $\pm$ 7.8  i) 5.8 $\pm$ .9** ii) 5.8 $\pm$ 1.1* i) 5.6 $\pm$ .7 ii) 5.7 $\pm$ .8  i) 77.3 $\pm$ 20.2* ii) 83.4 $\pm$ 18.3** i) 80.8 $\pm$ 18.3 ii) 88.2 $\pm$ 16.0	6 months	Randomized control trial 3
Basso et al. (2019)	Healthy adults with no meditation experience from New York 18-45 n = 42	i) Meditation – Listened to guided meditation for 13 minutes daily  ii) Control – Listened to podcast for 13 minutes daily	1) Mood (POMS): a) Before: b) After:  2) Anxiety (BAI) a) Before: b) After:  3) Fatigue (FSS): a) Before: b) After:	i) 33.333 $\pm$ 5.795** ii) 23.238 $\pm$ 6.530* i) 19.095 $\pm$ 8.719 ii) 22.190 $\pm$ 6.169  i) 11.238 $\pm$ 1.906* ii) 9.429 $\pm$ 1.788* i) 8.619 $\pm$ 2.028 ii) 12.048 $\pm$ 2.128  i) 32.714 $\pm$ 2.468** ii) 29.619 $\pm$ 2.996* i) 28.810 $\pm$ 2.640 ii) 30.714 $\pm$ 3.022	8 weeks	Randomized control trial 3
Lee et al., 2019	Adults with hypertension and/or type 2 diabetes from Seoul, South Korea 57-87 n = 48	i) Meditation – Brain-education meditation (BEM) classes, twice-weekly  ii) Control – Health education classes, twice-weekly	1) LDL cholesterol (mg/dL): a) Before: b) After:	i) 104.49 $\pm$ 32.73** ii) 86.57 $\pm$ 35.82**** i) 90.67 $\pm$ 35.54 ii) 97.36 $\pm$ 38.14	8 weeks	Randomized control pilot trial 4

\*  $p > 0.05$   
 \*\*  $p < 0.05$   
 \*\*\*  $p < 0.01$   
 \*\*\*\*  $p < 0.001$

BAI, Beck Anxiety Inventory; BEM, brain-education meditation, CAMS-R, Cognitive and Affective Mindfulness Scale-Revised; CAPS, Clinician-Administered PTSD Scale; CRM, consciously resting meditation;  $\Delta$ , change; FSS, Fatigue Severity Scale; HbA<sub>1c</sub>, hemoglobin A<sub>1c</sub>; ISI, Insomnia Severity Index; MOS SLP9, Medical Outcome Study Sleep Scale; PCL-M, PTSD Checklist – Military; POMS, Profile of Mood Scale; PSS, Perceived Stress Scale; PTSD, post-traumatic stress disorder; SCS, Self-compassion Scale; TM, transcendental meditation

Table 9.

*Mindfulness-Based Interventions – PICOTS and Jadad Table*

Author(s)	Population		Group	Outcome(s)		Timing	Study Type + Jadad Score
	Age (years)	Sample Size		Study Criteria	Study Result		
Brewer et al. (2009)	Adults with substance abuse problems from Connecticut	n = 36	i) MBSR – MBSR sessions for 1 hour, weekly	1) Anxiety (TCS):	i) 1.5 ± 2.1*** ii) 4.6 ± 1.5	12 weeks	Randomized control pilot trial 4
	44 ± 11		ii) Control – Cognitive behavioral therapy (CBT) sessions for 1 hour, weekly	2) Anxiety (DES):	i) 1.5 ± 3.9** ii) 7.0 ± 3.8		
Segal et al. (2010)	Adults with major depressive disorder in remission, on anti-depressants from Canada	n = 160	i) MBSR – MBSR sessions (8 sessions) for 2 hours, weekly	3) Stress-induced drug craving:	i) 1.1 ± 3.7* ii) 2.0 ± 3.1	18 months	Randomized control trial 5
	44 ± 11		ii) Control – Maintenance anti-depressants	1) Relapse (hazard ratio):	i) .26 ii) .24 ivii) 1.07		
Daubenmier et al. (2011)	Overweight and obese adult women with excess stress from California	n = 47	iii) Placebo – Placebo treatment, with clinical management			4 months	Randomized control pilot trial 4
	40.99 ± 7.21		i) MBSR – MBSR sessions for 2.5 hours (9 sessions) + at-home practice for ≤30 minutes, (6 days/week)	1) Mindfulness - awareness (KIMS):	i) .25 ± .5** ii) -.07 ± .3		
Barrett et al. (2012)	Generally healthy non-exerciser and nonmeditator adults, with a recent history of acute respiratory infection (ARI) from Wisconsin	n = 154	ii) Control – Non-meditation waitlist	2) Mindfulness – observational (KIMS):	i) .26 ± .5*** ii) -.08 ± .3	8 weeks	Randomized control trial 4
	59.3 ± 6.6		iii) Exercise – moderate-intensity exercise group sessions for 2.5 hours, weekly + 45 minutes, daily	3) Anxiety (STAI):	i) -.23 ± .4** ii) .00 ± .4		
Robins et al. (2012)	Generally healthy nonmeditator adults from North Carolina	n = 56	i) MBSR – MBSR sessions (8 sessions) for 2.5 hours, weekly + 45 minutes, daily	4) External-based eating (DEBQ):	i) -.41 ± .4** ii) -.09 ± .4	8 weeks	Randomized control trial 3
	46.25 ± 12.97		ii) Control – Non-meditation waitlist	1) Mindfulness (FFMQ):	i) 121.6 ± 20.31**** ii) 125.10 ± 22.13 i) 138.35 ± 13.27 ii) 125.76 ± 21.99		
				a) Before:			
				b) After:			
				2) Fear of emotional control (ACS):	i) 129.31 ± 35.08*** ii) 121.73 ± 38.20 i) 105.60 ± 26.28 ii) 115.48 ± 30.99		
				a) Before:			
				b) After:			
				3) Anger expression (SAES):	i) 12.45 ± 2.76*** ii) 15.33 ± 4.94 i) 11.55 ± 1.88 ii) 15.71 ± 4.54		
				a) Before:			
				b) After:			
				4) Emotional instability (DERS):	i) 89.66 ± 22.72*** ii) 82.89 ± 25.21 i) 72.00 ± 12.93 ii) 83.38 ± 19.27		
				a) Before:			
				b) After:			

Table 9 (Continued)

van Son et al. (2013)	Adults with diabetes mellitus and low emotional well-being from Tilburg, Netherlands 56.5 ± 13.0 n = 139	i) MBSR – MBSR sessions (8 sessions) for 2 hours, weekly + at-home practice for 30 minutes, (5 days/week)  ii) Control – Non-meditation waitlist + treatment as usual	1) Stress (PSS): a) Before: b) After:  2) Depressive symptoms (HADS): a) Before: b) After:  3) Anxiety (HADS): a) Before: b) After:  4) Quality of life - mental (SF-12): a) Before: b) After:  5) Quality of life - physical (SF-12): a) Before: b) After:	i) 19.5 ± 6.0**** ii) 20.5 ± 5.9 i) 17.3 ± 6.9 ii) 19.1 ± 6.4  i) 7.9 ± 3.8*** ii) 8.9 ± 3.9 i) 6.4 ± 4.3 ii) 8.5 ± 4.2  i) 8.4 ± 3.3** ii) 9.2 ± 3.6 i) 7.5 ± 4.1 ii) 9.0 ± 3.7  i) 33.9 ± 11.0*** ii) 32.5 ± 11.6 i) 42.9 ± 10.7 ii) 35.7 ± 12.5  i) 41.5 ± 9.9** ii) 38.9 ± 11.4 i) 43.5 ± 10.5 ii) 38.5 ± 11.7	8 weeks	Randomized control trial 3
Zernicke et al. (2013)	Adults with irritable bowel syndrome from Alberta, Canada 44.5 ± 12.4 n = 139	i) MBSR – MBSR sessions (8 sessions) for 1.5 hours, weekly + at-home practice for 45 minutes, daily  ii) Control – Non-meditation waitlist + treatment as usual (TAU)	1) Sense of purpose (FACIT-sp): a) Before: b) After:  2) Symptom severity (IBS-SSS): a) Before: b) After:  3) Quality of life (IBS-QOL): a) Before: b) After:  4) Stress (C-SQSI): a) Before: b) After:  5) Mood (POMS): a) Before: b) After:	i) 27.5 ± 8.5*** ii) 25.9 ± 8.9 i) 30.5 ± 10.5 ii) 26.8 ± 9.6  i) 248.6 ± 108.9** ii) 249.0 ± 107.6 i) 169.4 ± 125.9 ii) 213.8 ± 119.3  i) 65.3 ± 23.6** ii) 61.6 ± 23.3 i) 75.0 ± 24.9 ii) 63.1 ± 23.3  i) 76.7 ± 34.8**** ii) 81.7 ± 34.3 i) 52.2 ± 40.7 ii) 75.7 ± 37.7  i) 48.6 ± 36.7**** ii) 50.1 ± 36.3 i) 28.5 ± 45.9 ii) 37.4 ± 41.8	8 weeks	Randomized control trial 5
Williams et al. (2014)	Adults with major depressive disorder in remission from Oxford and Bangor, UK 43 ± 12 n = 274	ii) MBCT – Mindfulness-based cognitive therapy 2-hour sessions, weekly + TAU  ii) Control – TAU  iii) CPE – Cognitive psychological education sessions for 2 hours, weekly + TAU	1) Relapse (hazard ratio):  2) Relapse with childhood trauma (hazard ratio):	iVii) .68* iViii) .88*  iVii) .43*** iViii) .61*	8 weeks	Randomized , control trial 5
Huijbers et al. (2015)	Adults with major depressive disorder in remission, on anti-depressants from the Netherlands 51.7 ± 14.2 n = 68	i) MBSR – MBSR sessions for 2.5 hours, weekly (8 sessions) + maintenance anti-depressants  ii) Control – Maintenance anti-depressants	1) Quality of life - overall (WHO-QOL): a) Before: b) After:  2) Quality of life - mental (WHO-QOL): a) Before: b) After:	i) 3.7 ± .7* ii) 3.8 ± .8 i) 3.8 ± .7 ii) 3.8 ± 1.0  i) 19.3 ± 3.2* ii) 20.1 ± 3.9 i) 20.5 ± 3.3 ii) 20.4 ± 3.7	8 weeks	Randomized control trial 4



Table 9 (Continued)

Kuyken et al. (2015)	Adults with major depressive disorder in remission, on anti-depressants from southwestern United Kingdom  49.5 ± 12.5      n = 424	i) MBSR – MBSR sessions (8 sessions) for 2.25 hours, weekly  ii) Control – Maintenance anti-depressants	1) Depression (GRID-HAMD): a) Before: b) After:  2) Depression (BDI): a) Before: b) After:  3) Relapse with childhood trauma (hazard ratio):	i) 4.8 ± 4.3* ii) 4.6 ± 4.3 i) 4.7 ± 4.8 ii) 4.7 ± 5.7  i) 13.8 ± 12.4* ii) 14.4 ± 10.1 i) 11.6 ± 10.9 ii) 11.9 ± 10.7  i) .53**	8 weeks	Randomized control trial 4
Polusny et al. (2015)	Adult war veterans with PTSD from Minnesota  58.5 ± 9.8      n = 116	i) MBSR – MBSR sessions (8 sessions + 1 retreat) for 2.5 hours, weekly  ii) Control – Present-centered therapy sessions (9 sessions) for 1.5 hours, weekly	1) PTSD (CAPS score): a) Δ between groups b) Δ follow-up  2) PTSD (PCL-M score): a) Δ between groups b) Δ follow-up  3) Quality of life (WHOQOL-BREF): a) Δ between groups b) Δ follow-up  4) Mindfulness (FFMQ): a) Δ between groups b) Δ follow-up	i) 4.95 ± 3.03*** ii) 6.44 ± 3.10****  i) 2.35 ± 5.1* ii) 7.89 ± 4.01***  i) 3.10 ± 3.39* ii) 5.22 ± 3.49***  i) 9.14 ± 5.23**** ii) 9.73 ± 5.31****	9 weeks + 8-week follow-up	Randomized control trial 4
Tang, Poon & Kwan (2015)	Adults with drug-resistant epilepsy from Hong Kong 35.12 ± 10.67      n = 60	i) MBSR – MBSR sessions for 2.5 hours, biweekly  ii) Control – Social support sessions for 2.5 hours, biweekly	1) Depression (BDI-II):  2) Anxiety (BAI):  3) Quality of life (QOLIE-31-P):  4) Cognitive effect (QOLIE-31-P):  5) Cognitive function (CAVLT-ImmRA):	i) -5.53** ii) -4.07  i) -5.37** ii) -2.83  i) 6.23** ii) 3.30  i) 6.43** ii) 2.27  i) 1.57** ii) .40	18 weeks	Randomized control trial 4
Daubenmier et al. (2016)	Obese adults from California 46.98 ± 12.71      n = 194	i) MBSR – MBSR sessions for 2.5 hours (16 sessions) + at-home practice for ≤30 minutes, (6 days/week) + diet and exercise advice  ii) Control – Progressive muscle relaxation & cognitive-behavioral training sessions for 2.5 hours (16 sessions) + diet and exercise advice	1) Weight loss (kg):  2) Fasting blood glucose (mg/dL):  3) Triglycerides/HDL ratio:	i) -4.2 ± 1.0* ii) -2.4 ± 1.0  i) -.31 ± 1.1*** ii) 3.8 ± 1.2  i) -.27 ± .1* ii) .9 ± .1	5.5 months	Randomized control trial 5

Table 9 (Continued)

Lengacher et al. (2016)	Adult women who survived breast cancer from Florida 56.6 ± 9.7 n = 332	i) MBSR – MBSR sessions (6 sessions) for 2 hours, weekly + at-home practice for 15-45 minutes, daily  ii) Control – Non-meditation waitlist + TAU	1) Depression (CES-D): a) Before: b) After:  2) Anxiety (STAI-S): a) Before: b) After:  3) Fear of relapse – overall (CARS): a) Before: b) After:  4) Quality of life – overall (SF-36): a) Before: b) After:  5) Fatigue – severity (FSI): a) Before: b) After:  6) Fatigue – interference (FSI): a) Before: b) After:	i) 10.87 ± 6.89* ii) 10.04 ± 6.46 i) 8.12 ± 5.45 ii) 8.82 ± 6.05  i) 38.62 ± 12.3*** ii) 35.86 ± 11.29 i) 30.62 ± 12.8 ii) 31.76 ± 13.2  i) 12.29 ± 5.64*** ii) 10.75 ± 5.57 i) 9.77 ± 5.34 ii) 9.85 ± 5.4  i) 62.63 ± 21.24** ii) 66.29 ± 20.76 i) 67.93 ± 19.87 ii) 68.28 ± 21.28  i) 16.38 ± 8.79*** ii) 14.48 ± 8.36 i) 12.33 ± 7.59 ii) 13.27 ± 8.71  i) 30.27 ± 21.78*** ii) 25.51 ± 19.93 i) 20.25 ± 16.35 ii) 21.45 ± 18.2	6 weeks	Randomized control trial 4
Momeni et al. (2016)	Adults with cardiovascular disease from Kashan, Iran 47 ± 7 n = 60	i) MBSR – MBSR sessions (8 sessions) for 2.5 hours, weekly + at-home practice for 15-45 minutes, daily  ii) Control – TAU	1) Systolic blood pressure (mmHg): a) Before: b) After:  2) Perceived stress (PSS): a) Before: b) After:  3) Anger – state (STAXI-2): a) Before: b) After:	i) 134.16 ± 7.99**** ii) 131.16 ± 8.06 i) 118.33 ± 7.46 ii) 128.33 ± 12.05  i) 30.25 ± 9.59**** ii) 37.50 ± 2.73 i) 16.74 ± 4.76 ii) 33.46 ± 5.91  i) 27.33 ± 7.09**** ii) 27.13 ± 5.10 i) 14.37 ± 3.96 ii) 28.03 ± 3.96	8 weeks	Single-blind, randomized control trial 4
Gotink et al. (2017)	Adults with cardiovascular disease, aged years, from Rotterdam, Netherlands 43.2 ± 13.9 n = 324	i) MBSR – MBSR sessions (12 sessions) delivered online, weekly  ii) Control – TAU	1) Exercise capacity (6MWT): a) Before: b) After:  2) Systolic blood pressure (mmHg): a) Before: b) After:  3) SBP (mmHg) (as treated): a) Before: b) After:	i) 537.5 ± 7.0* ii) 549.0 ± 81.6 i) 539.3 ± 67.3 ii) 532.9 ± 82.8  i) 127.5 ± 16* ii) 125.4 ± 15 i) 123.8 ± 17 ii) 125.4 ± 17  i) 129.7 ± 22.8** ii) 125.8 ± 23.8 i) 124.4 ± 27.3 ii) 126.1 ± 29.2	12 weeks	Randomized control trial 4

# FASTING & PRAYER FOR MDOC

Table 9 (Continued)

Kenne Sarenmalm et al. (2017)	Adult women who survived breast cancer from Sweden 57.2 ± 10.2 n = 166	i) MBSR – MBSR sessions (8 sessions) for 2 hours, weekly + at-home practice for 20 minutes, (6 days/week)  ii) Control – Non-MBSR TAU iii) Active-control – MBSR self-instruction at-home for 20 minutes, (6 days/week)	1) Depression (HADS): a) Before: b) After:  2) Psychological symptoms (MSAS): a) Before: b) After:  3) Global distress (MSAS): a) Before: b) After:  4) Mental health (SF-36): a) Before: b) After:  5) Coping capacity (SoC): a) Before: b) After:  6) Personal growth (PTGI): a) Before: b) After:  7) Natural killer cells – absolute count: a) Before: b) After:	i) 4.3 ± 3.7** ii) 3.5 ± 3.5 i) 3.3 ± 3.3 ii) 3.8 ± 3.8  i) 1.4 ± 0.8** ii) 0.9 ± 0.8 i) 1.2 ± 0.9 ii) 0.9 ± 0.8  i) 1.9 ± 0.6** ii) 1.6 ± 0.8 i) 1.8 ± 0.6 ii) 1.7 ± 0.9  i) 67.9 ± 19.0**** ii) 76.2 ± 20.0 i) 74.1 ± 17.1 ii) 74.4 ± 20.7  i) 65.7 ± 13.7** ii) 71.4 ± 11.1 i) 67.7 ± 12.0 ii) 69.3 ± 11.5  i) 59.78 ± 19.5*** ii) 52.58 ± 19.2 iii) 55.92 ± 20.2 i) 64.65 ± 17.7 ii) 51.57 ± 20.8 iii) 57.13 ± 17.6**  i) 0.24 ± 0.16** ii) 0.20 ± 0.11 i) 0.22 ± 0.10 ii) 0.22 ± 0.13	3 months	Randomized control trial 3
Reich et al. (2017)	Adult women who survived breast cancer from Florida  Mean = 56.6 n = 332	i) MBSR – MBSR 2-hour sessions (6 sessions), weekly + at-home practice for 15-45 minutes, daily  ii) Control – Treatment as usual	1) Psychological cluster – (Depression + Anxiety + Stress + Emotional Well-being model):  2) Fatigue cluster – (Fatigue + Sleep + Drowsiness):	***  ****	6 weeks	Randomized control trial 3
Shomaker et al. (2017)	Adolescents girls with depression at-risk for type 2 diabetes mellitus from Colorado 12-17 n = 33	i) MBSR – MBSR sessions (6 sessions) for 1 hour, weekly + at-home practice for ~10 minutes, daily  ii) Control – Cognitive behavioral therapy (CBT) sessions (6 sessions) for 1 hour, weekly	1) Depression (CES-D):  2) Insulin resistance:  3) Fasting serum insulin: (μU/mL):	i) -11.17 ± 1.36** ii) -7.45 ± 1.35  i) -0.39 ± 0.38** ii) 0.73 ± 0.34  i) -0.50 ± 0.86** ii) 2.00 ± 0.85	6 weeks	Randomized control pilot trial 4
Barrett et al. (2018)	Generally healthy non-exercisers and nonmeditators, with a recent history of acute respiratory infection from Wisconsin  49.6 ± 11.6 n = 413	i) MBSR – MBSR sessions for 2.5 hours, weekly + 45 minutes, daily  ii) Control – Clinical observation  iii) Exercise – moderate intensity exercise group sessions for 2.5 hours, weekly + 45 minutes, daily	1) ARI incidence (%) (versus control):  a) MBSR – multivariate analysis  2) ARI global severity (versus control):  a) MBSR – multivariate analysis  3) ARI illness length (days) (versus control):	i) 0.16 ± 0.23* iii) 0.10 ± 0.23* **  i) 70 ± 116* iii) 102 ± 106* **  i) 1.2 ± 2.8* iii) 1.4 ± 2.6*	8 weeks	Randomized control trial 4

Table 9 (Continued)

Cejudo et al. (2019)	Adult women with fibromyalgia from Ciudad Real, Spain 47.59 ± 5.93 n = 104	i) MBSR – MBSR sessions (20 sessions) for 2 hours, weekly + at-home practice for 20 minutes, daily  ii) Control – TAU	1) Satisfaction with life (SWLS): a) Before: b) After:  2) Positive affect (PANAS): a) Before: b) After:  3) Mental health (MH5): a) Before: b) After:  4) Resilience (ER-14): a) Before: b) After:	i) 23.72 ± 5.72** ii) 23.81 ± 5.85 i) 24.98 ± 5.62 ii) 23.82 ± 5.96  i) 21.32 ± 5.04** ii) 21.03 ± 5.24 i) 23.73 ± 4.92 ii) 21.12 ± 5.61  i) 15.48 ± 5.29** ii) 16.01 ± 3.22 i) 16.92 ± 3.7 ii) 15.39 ± 4.95  i) 38.53 ± 7.12** ii) 39.04 ± 7.01 i) 41.98 ± 6.96 ii) 38.92 ± 6.84	20 weeks	Randomized control trial 3
Epel et al. (2019)	Low-income adult pregnant women from California 27.9 ± 5.8 n = 225	i) MBSR – MBSR sessions (8 sessions) for 2 hours, weekly + at-home practice  ii) Control – TAU	1) Perceived stress (PHQ-9): a) Before: b) After:  2) Depressive symptoms (PHQ-9): a) Before: b) After:  3) Oral glucose tolerance (24 weeks):	i) 19.1 ± 6.6** ii) 18.4 ± 6.6 i) 15.6 ± 5.8 ii) 17.0 ± 7.4  i) 7.6 ± 5.6*** ii) 6.8 ± 4.9 i) 4.5 ± 3.7 ii) 6.1 ± 4.5  i) 100.3 ± 23.3*** ii) 111.8 ± 27.7	8 weeks	Non-randomized control trial 2
Jalali et al. (2019)	Adults with cardiovascular disease from southwest Iran 52.06 ± 10.08 n = 60	i) MBSR – MBSR sessions (8 sessions) for 2 hours, weekly + at-home practice  ii) Control – TAU	1) Self-efficacy (Sherer et al. scale): a) Before: b) After:  2) Quality of life (SF-36): a) Before: b) After:	i) 53.82 ± 10.59**** ii) 53.20 ± 9.22 i) 60.80 ± 5.91 ii) 50.30 ± 7.48  i) 90.76 ± 7.21**** ii) 88.80 ± 6.96 i) 103.80 ± 9.35 ii) 87.83 ± 8.95	8 weeks	Randomized control trial 3
Shomaker & Berman, et al. (2019)	Generally healthy adolescents at-risk for weight gain issues from Colorado 12-17 n = 54	i) MBSR – MBSR sessions (6 sessions) for 1 hour, weekly + at-home practice for ~10 minutes, daily  ii) Control – Health education classes (6 sessions) for 1 hour, weekly	1) Food reward sensitivity: a) Before: b) After:  2) Stress-eating (kcal): a) Before: b) After:	i) 53.82 ± 10.59*** ii) 53.36 ± 12.57 i) 37.99 ± 9.72 ii) 61.67 ± 10.47  i) 745.51 ± 70.59** ii) 779.25 ± 76.03 i) 786.00 ± 66.92 ii) 989.09 ± 72.08	6 weeks	Randomized control pilot trial 4
Shomaker, Pivarunas, et al. (2019)	Adolescents girls with depression at-risk for type 2 diabetes mellitus from Colorado 12-17 n = 32	i) MBSR – MBSR sessions (6 sessions) for 1 hour, weekly + at-home practice for ~10 minutes, daily  ii) Control – Cognitive behavioral therapy (CBT) sessions (6 sessions) for 1 hour, weekly	1) Depression (CES-D):  2) Insulin resistance:	i) -14.17 ± 4.05** ii) -7.65 ± 4.02  i) -1.26 ± .82*** ii) .57 ± .79	6 weeks	Randomized control pilot trial 3

Table 9 (Continued)

Elimimian et al. (2020)	Hispanic adult women who survived breast cancer from Texas 55 ± 8.5 n = 33	MBSR – MBSR sessions (8 sessions) for 2 hours, weekly + at-home practice, daily	1) Anxiety (GAD7): 2) Depression (PHQ-9): 3) Quality of life - mental (SF-36):	-2.39 ± 2.28** -2.27 ± 2.13** 4.07 ± 3.59**	24 months	Non-randomized control trial 2
López-Alarcón et al. (2020)	Obese children with anxiety issues from Mexico City 10-17 n = 45	i) MBSR – MBSR sessions for 2 hours, weekly + at-home practice + conventional hypocaloric nutrition intervention ii) Control – Conventional hypocaloric nutrition intervention	1) Body fat (%): 2) Serum ghrelin: (pg/mL): 3) Serum cortisol (µg/dL): 4) Anxiety (Spence self-report):	i) -1.28 ± .25* ii) -1.24 ± .91 i) -.71 ± .37** ii) .83 ± .75 i) -1.42 ± .94 ** ii) 2.26 ± .93 i) -6.21 ± 1.10**** ii) .66 ± .64	8 weeks	Non-randomized control trial 2

\*  $p > 0.05$

\*\*  $p < 0.05$

\*\*\*  $p < 0.01$

\*\*\*\*  $p < 0.001$

6MWT, 6 Minute Walking Test; ACS, Affective Control Scale; ARI, acute respiratory illness; BAI, Beck Anxiety Inventory; BDI(II), Beck Depression Inventory; BMI, body mass index; CAPS, Clinician-Administered PTSD Scale; CARS, Concerns About Recurrence Scale; CAVLT, Chinese Auditory Verbal Learning Test; CBT, cognitive behavioral therapy; CES-D, Center for Epidemiologic Studies-Depression Scale; CPE, cognitive psychological education; C-SOSI, Calgary Symptoms of Stress Inventory; Δ, change; DEBQ, Dutch Eating Behavior Questionnaire; DERS, Difficulties in Emotion Regulation Scale; DES, Differential Emotion Scale; ER-15, Resilience Scale; FACIT-sp, Functional Assessment of Chronic Illness Therapy—Spiritual Well-being Scale; FFMQ, Five Facets Mindfulness Questionnaire; FSI, Fatigue Symptom Inventory; GAD7, Generalized Anxiety Disorder Questionnaire-7; GRID-HAMD, GRID-Hamilton Rating Scale for Depression; HADS, Hospital Anxiety and Depression Scale; IBS-QOL, Irritable Bowel Syndrome Quality of Life; IBS-SSS, Irritable Bowel Syndrome Severity Scoring System; ImmRA, immediate recall after interference; KIMS, Kentucky Inventory of Mindfulness Skills; MBCT, mindfulness-based cognitive therapy; MSAS, Memorial Symptom Assessment Scale; MBSR, mindfulness-based stress reduction; MH5, Mental Health Scale; PANAS, Positive And Negative Affect Scale; PCL-M, PTSD Checklist – Military; PHQ-9, Patient Health Questionnaire-9; POMS, Profiles of Mood States; PTGI, Posttraumatic Growth Inventory; QIDS, Quick Inventory of Depressive Symptomatology; QOLIE-31-P, Patient-Weighted Quality of Life in Epilepsy Inventory; SAES, Spielberger Anger Expression Scale; SoC, Sense of Coherence; STAI, State-Trait Anxiety Inventory; STAXI-2, Spielberger's State-Trait Anger Expression Inventory; SWLS, Satisfaction With Life Scale; SF-12, 12-Item Short Form Health Survey; SF-36, 36-Item Short Form Health Survey; TAU, treatment as usual; TCS, Treatment Credibility Scale; WHOQOL-BREF, World Health Organization Quality of Life–Brief

**Research Question 3: Assessment of Current Understanding of Domains of  
“Health.”**

The purpose of this paper is to comparatively analyze the theoretical and empirical efficacy of Eastern Orthodox Christian ascetic practices for the reduction of chronic disease burden through three dimensions: physical, mental, and spiritual. It has been proposed that the spiritual dimension has been particularly underserved through the loss of the conception of the *nous* in Western, hyperrationalistic thought. Furthermore, through the engagement of the *nous*, therapeutic benefits may be achieved. Thus, although there has been tremendous growth in the literature on physical exercises originating in the Far Eastern traditions and fasting from various other religions, Orthodox Christianity, with its longer than two thousand years of history, represents an area ripe for clinical inquiry.

Moreover, the Orthodox Christian framework provides an alternative hypothesis with potentially greater explanatory power, concerning “mental” health conditions. The current standard Western medical model exhibits a purely materialist metaphysics, which has resulted in a society that is systemically sick through multiple dimensions. Subsequently, due to presuppositions that the body and mind are solely the epiphenomenal byproduct of biochemical reactions, this has led to the widespread overprescription of pharmaceutical drugs, often with unsatisfactory outcomes. An inadequate understanding of the etiology of the disease leads to suboptimal diagnoses, treatments, and prognoses. Through the integration of the *nous* as a clinical target, the spiritual dimension becomes an open door that is currently imperfectly characterized merely under the umbrella of “mental” health.

While the *nous* represents a transcendent domain that is difficult to quantify, the author contends that it is just as valid an area of clinical inquiry as “consciousness,” which will be explored in the next two questions.

**Research Question 4: Assessment of the Logical Coherence of Secular and Non-Orthodox Christian Paradigms to Epistemically Support the Reliability of their Outcomes**

In the process of scientific inquiry and clinical practice, there are a host of things that are presupposed in order to reach conclusions, including (a) the existence of logic, by which to reason about a given set of data; (b) the reliability of the senses, which can record that data; (c) the existence of mathematics and numbers, which can quantify and statistically analyze that data; and (d) the existence of consciousness and a “self,” which can accurately interpret and relay that sense data through induction. While there are many others, those examples represent a basic primer, from which the absurdity of the current paradigms can be explored. There is no presuppositional neutrality in the use of these concepts, yet their ontological reality is necessary as a precondition for the possibility of knowledge. Thus, what follows is a metalogical analysis of the justifications of their existence, as logic, experience, mathematics, and reason cannot be utilized to justify their existence without epistemic bootstrapping, i.e., circular reasoning (Sorem, 2020).

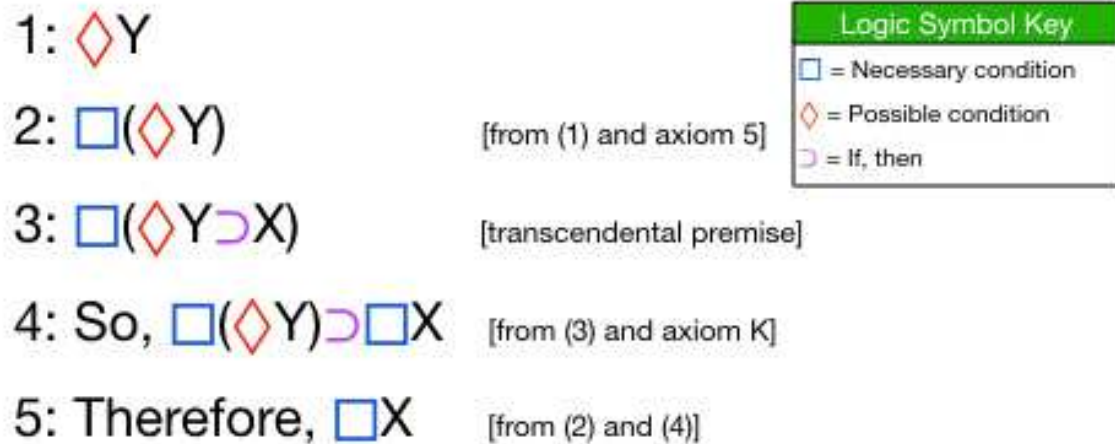


Figure 3. S5 Modal Syllogism for the justification of presuppositions. Adapted from 'An Orthodox theory of knowledge: The epistemological and apologetic methods of the Church Fathers,' by E. Sorem, 2020., SOPHIA Conference, Kendalia, TX. Adapted with permission.

As illustrated in Figure 3, for Y condition to be possible (1), it is necessary for the possibility of condition Y (2), that condition X is also met (3); so, if the necessity of condition Y is possible, then it obtains that condition X is also necessary (4); therefore, condition X is necessary. Condition X is not merely something discovered empirically, but rather an *a priori* logical and metaphysical necessity for the possibility of Y.

Using this syllogism for the examples above, whereby Y represents: (a) logic, (b) the reliability of the senses, (c) mathematics and numbers, and (d) reason, consciousness and the “self,” it is possible to examine the reliability of the conclusions drawn from the various paradigms, explored in this review.

While people can often come to illogical and irrational inferences, (a) the laws of logic remain universal and invariant, yet also immaterial. As such, these laws of logic cannot merely be the byproduct of human constructs, which poses problems for materialists. Conversely, despite the psychological limitations of humans to



conceptualize a counterfactual to the existence of logic, the universality of logic is not definite, without an external justification, i.e., necessary condition X (Sorem, 2020).

Through human reasoning alone, it is impossible to escape circularity, as logic is presupposed in the very process. Thus, for rationalists, who appeal explicitly to reason as their epistemic foundation, the result is incoherent (Sorem, 2020).

As an adjunct, beyond the metaphysical implications of logic qua logic, there are the ethical considerations, i.e., that one “should” be logical. Thus, an objective morality is a necessary precondition for engaging in the scientific method inasmuch as it implies an “ought” claim. However, in a world of constant chaos and flux, there is no reason to presuppose the existence of, or the ability to properly adjudicate between what is “right” and “wrong” (Sorem, 2020). Consequently, this relativistic understanding of logic becomes self-contradictory and irrational.

Whether by intoxication, psychosis, or hallucination, it is well understood and accepted that (b) the senses can be impaired. Thus, without an external necessary condition X, it would be impossible to know whether the senses are in fact reliable, or if everyone is operating on a collective delusion. This problem is particularly challenging for empiricists who appeal to sense data as the ultimate arbiter of “knowing,” as even if their conclusions were “true,” they would have no means of being certain, without once again resorting to epistemic bootstrapping (Sorem, 2020).

Gödel’s incompleteness theorems established that mathematics and logic cannot prove (c) numbers, nor validate their own consistency (Marchal, 2017). Moreover, Gödel determined that the existence of unsolvable mathematical problems disproves the possibility of mathematics being merely the result of creations of the human mind, which

causes problems for mechanists and rationalists (Raatikainen, 2005). This fact has led some mechanists to argue for a “universal machine” that functions as the necessary condition X, specifically for mathematics (Marchal, 2015; 2017). However, without an immanent and personal expression in the world, this still falls to the same epistemic problems, i.e., these “truths” would be inaccessible to the human mind or experience (Sorem, 2020).

Concerning (d) the “self” and “consciousness,” it becomes apparent that there needs to be a locus for empirical experience, which can determine, experience, perceive, and interpret sensory data. However, this creates an internal contradiction for behaviorists, biological naturalists, and the Far Eastern traditions, as these systems generally consider the “self” to be nonexistent or illusory (Diller & Lattal, 2008; Shiah, 2016; Stankevicius, 2017). Similarly, consciousness is equally undoubtable, yet unjustifiable, as materialists, dualists, biological naturalists, and mechanists all fall into the same problems of circularity or infinite regress (Sorem, 2010; Marchal, 2017; Stankevicius, 2017).

These statements may lead to the argument that there is no need for a justification for the laws of logic or mathematics or the reliability of senses, that they “just are.” This *a posteriori success-based* rationality argues that the results themselves provide sufficient rational justification (Schurz, 2014; Schurz & Hertwig, 2019). However, this attempt at pragmatism is arbitrary and specious, discounting the possibility of ever “knowing” anything. Just as it would be inappropriate to make claims within the domain of scientific inquiry without good reason, it is even more essential to be certain that the entire scientific enterprise is well-grounded.

In the absence of sufficient justification for whatever is inserted for necessary condition X, all subsequent conclusions are equally ungrounded solipsism, subject to circular reasoning, and consequently taken as items of faith (Raatikainen, 2005; Sorem, 2020). Thus, as the governing presuppositions of secular materialism and the Far Eastern philosophies are irrational, any conclusions drawn will ultimately be suboptimal, irrespective of any perceived physiological benefit.

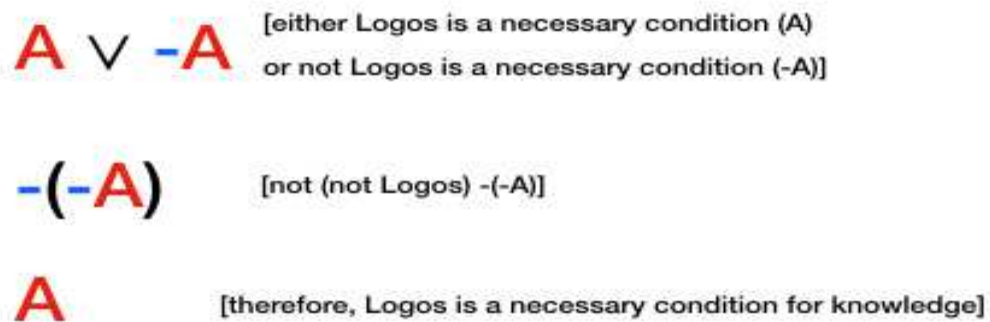
### **Research Question 5: Assessment of the Explanatory Power of the Eastern Orthodox Christian Paradigm in Addressing the Resolution of Diseases of Modern Civilization**

Utilizing the S5 modal syllogism from Figure 3 again, with the *Logos* representing X, all of the preconditions for intelligibility are met. Logic (a) is a reflection of the mind of the *Logos*; (b) the senses are generally reliable as they are designed by the *Logos* as the means of understanding and interpreting His creation; (c) mathematics are a description of the logical order of the universe, as maintained through the *logoi*, within the *Logos*; and (d) the self and consciousness are justified in having been made in His image.

While one is free to reject the metaphysics of the Eastern Orthodox Christian paradigm, in doing so, they will lose any justification to the veracity of their knowledge. This is due to the necessity of the development of an epistemic calculus, (which blindly accepts an incredible multitude of ungrounded variables), to simply begin concluding anything. Moreover, the rhetorical appeal of the argument does not undermine its logical validity. There will be a level of faith required, regardless of what one uses as their

necessary condition X; however, in operating with an acceptance of the *Logos*, one can maintain internal logical consistency and coherence, without being solipsistic.

As further illustrated in Figure 4, in the form of a disjunctive syllogism: (1) either the *Logos*, as articulated by the tradition of Eastern Orthodox Christianity is a necessary condition for the existence of knowledge, or He is not; (2) as addressed in Question 4, the various autonomous epistemological projects are unable to provide sufficient justifications for the existence of knowledge in the absence of the *Logos*; therefore (3) the *Logos* is a necessary condition for the existence of knowledge.



*Figure 4. Disjunctive syllogism Adapted from ‘An Orthodox theory of knowledge: The epistemological and apologetic methods of the Church Fathers,’ by E. Sorem, 2020., SOPHIA Conference, Kendalia, TX. Adapted with permission.*

To be clear, as has been mentioned, this does not mean that an individual has to personally accept the Eastern Orthodox Christian worldview to utilize logic, reason, mathematics, the self, or the even scientific method, any more than an individual has to personally acknowledge the existence of air to breath. However, what it does provide is the only logically- and metalogically-coherent means of having epistemic certainty in their pursuit of knowledge. Thus, it gives the rationale for the further development of

research into the Eastern Orthodox ascetic practices, while also interpreting the data derived from similar practices in other traditions.

As was discussed in this review, the concepts of the *nous*, the *pathoi*, and *metanoia* provide a “novel,” yet traditional, area of inquiry into the chronic diseases of modern civilization that is currently underutilized. The ascetic practices of fasting and *hesychastic* prayer are a means of engaging the *nous*, in the resolution of the *pathoi*, through the development of *metanoia*. Through a greater appreciation for the Orthodox Christian epistemology and anthropology, it may be possible to make more considerable advances in the domains of health that are currently unsatisfactory.

## **CHAPTER 5: CONCLUSIONS**

### **Objective 1: Assessment of the Epidemiology and Current Standard of Treatment for Chronic Disease and “Mental Health” from a Western Medical Perspective.**

Throughout this literature review, chronic disease and “mental” health issues were established as representing the biggest drivers of morbidity and mortality in the Western world today. Much of this is due to poor life choices, often characterized by existential crises, although this is not always explicitly apparent on the surface. In the earlier stages, this is often expressed simply in sedentary lifestyles, paired with overeating, as the primary drivers of disease. However, in a more advanced state of crisis, this dissatisfaction manifests in more recognizable conditions, e.g., depression and other neuroses.

As was discussed in Chapter 1, approximately three out of every ten Americans are obese, and more than one third is overweight (Brewer et al., 2018). Additionally, more than half of American adults suffer from at least one chronic health condition, with roughly one quarter experiencing multiple conditions (Ward & Schiller, 2013). These conditions, both independently and concomitantly, increase the risk of psychological issues, suicidal ideation, and illicit substance abuse (Wu, Zhu, & Ghitza, 2019; Rajbhandari-Thapa et al., 2019). Collectively, this characterizes the most significant driver of disability, death, and reduced health and quality of life, in the United States (Bauer et al., 2014; Razzoli et al., 2017).

### **Objective 2: Assessment of the Epistemic and Teleological Foundations of Eastern Orthodox Christian Ascetic Practices and Examination of Evidence for Empirical Efficacy**

An examination into the traditional understanding of the Orthodox Christian anthropology has provided an alternative hypothesis to the conventional Western paradigm for the development of therapeutic options. The associated ascetic practices are designed to address the physical, psychological, and noetic well-being of the person. While the research is not as expansive as for other traditions, the extant literature for Orthodox Christian fasting and *hesychastic* prayer is promising enough to encourage further clinical investigation.

### **Objective 3: Assessment of the Comparative Empirical Efficacy of Ostensibly Similar Practices from Other Traditions**

A comparative examination into exoterically similar methodologies from other traditions, including (a) different religious fasting, (b) intermittent fasting, (c) yoga, (d) meditation, and (e) mindfulness-based stress reduction, has yielded empirical evidence for the potential therapeutic efficacy of these treatments. Collectively, these practices have demonstrated benefits in improving life quality and span, as well as reducing disease burden. As such, given the higher degrees of logical coherence, it would be prudent to investigate further the therapeutic potential of the Eastern Orthodox ascetic practices.

### **Objective 4: Determination of the Therapeutic Potential of Eastern Orthodox Christian Ascetic Practices in the Mitigation of the Diseases of Modern Civilization**

These results are especially promising as these diseases represent the most significant epidemics of modern society. Given the poor outcomes of Western medicine in these fields, it is woefully apparent that a different approach is necessary if there is to

be an abating of these epidemics. Through the integration of traditional practices and understanding into modern developments in the healthcare field, there is tremendous potential to improve the quality of lives of countless people worldwide.

**Limitations of this Research.** The primary limitation of this research is the relative lack of available literature, specifically conducted using an Orthodox Christian methodology. As such, much of the review has to resort to comparisons with ostensibly similar, yet fundamentally distinct practices. While this does provide some evidence, it is insufficient to provide conclusive proof. Thus, there needs to be further investigation explicitly into Orthodox Christian asceticism.

An additional limitation is that in adopting the Orthodox Christian metaphysical claims, there is a degree of exclusion, concerning religious practice. While it is the position of the author that the logical coherence of Orthodox Christianity makes it the appropriate course forward, the nature of free will dictates that individuals possess the right to self-determination in personal faith choices. Therefore ethically, these practices must be undertaken voluntarily and complete with informed consent. Ideally, the practices are followed under the concomitant guidance of a spiritual father, who by proxy acts as their healthcare provider. More specifically, a spiritual father assumes the role of a therapist when concerning the healing of the *nous*.

**Future Directions and Implications.** Moving forward, Eastern Orthodox Christian ascetic practices represent a method of dietary and psychosomatic activities that are similar to concurrently utilized and researched modalities; however, the associated metaphysics have stronger logical consistency, both internally and externally concordant to investigation through the scientific method.



Utilizing an Orthodox Christian anthropology opens the door to insights that are unavailable from the conventional Western medical paradigm. In other words, while physiological manifestations are important and entirely real, they are of secondary ontological status, concerning the etiology of many of the modern epidemics. Whereas there has long been an issue with how to systematize the spiritual for academic and clinical research, the inclusion of the conception of the *nous* allows for greater explanatory power and a means of addressing existential conditions that are not purely biochemical in nature.

Modern society has developed a population whose minds are restless, wherein individuals never stop to ask themselves, “what is it that my mind is searching for?” They have a full refrigerator, yet have “nothing to eat,” and thus reach for convenience foods. There are innumerable opportunities to engage in new activities, which stimulate the mind, body, and spirit, yet they remain sedentary on the couch watching endless television, streaming services, or browse on their smart devices. Even worse yet, they indulge their hedonistic passions and engage in abuses to the body, e.g., tobacco, alcohol, illicit substances, or risky bodily lusts. This restlessness only further illustrates the potential benefits of vigilance and asceticism, whose means of dispassion is not the repression of thoughts, which can have physiological effects if left unattended. Rather, there is a conscious choice to not act on them, allowing for the subsequent redirection of the passions. Synthesizing those ideas, it is possible to examine the efficacy of these methods when implemented from within the proper framework.

However, beyond the paradigmatic level, from a more materialist perspective, other areas that deserve more in-depth exploration in future research are: (a) the

optimization of nutrient status, while remaining faithful to the fasts; (b) the role of asceticism itself, i.e., effects on hormetic stress response and or alterations to the microbiome; and (c) improvements in “mental health,” if examined with that understanding.

### **Orthodox Christian Ascetic Practice Case Series Proposal**

Throughout this examination, the Eastern Orthodox Christian ascetic practices were explored for potential efficacy, both theoretically and comparatively; however, at this point, a proposal for future investigation will be more directly articulated. As discussed earlier, along with the weekly 5:2 fasting practice, Orthodox Christians participate in several longer fasts, of which the Nativity and Lenten Fasts (preceding Christmas and *Pascha*/Easter, respectively) are the most significant. Beyond simple abstinence from food, these periods are to include increased prayer, liturgical attendance, confession, and almsgiving; thus, there are additional lifestyle factors beyond simple dietary modification.

For this prospective case series trial, five practicing Orthodox Christians will undergo testing through several dimensions, both at baseline and shortly before the conclusion of one of these fasting seasons, including: (a) anthropometric data; (b) serum cardiometabolic biomarkers; (c) urinary organic acid biomarkers; and (d) patient-reported outcome questionnaires; as illustrated in Table 10.

This data will be useful in determining the effectiveness of fasting and hesychastic prayer practices in improving physiological, psychological, and spiritual health. As both the Nativity and *Pascha* are essential events for Orthodox Christians, it would be imprudent to expect testing to be able to occur on these days. Thus, the

secondary testing will occur at 35 days during the fast, with the consent of the individual and the right reserved by the investigators for follow-up testing after the holiday for further evaluation. Beyond being currently baptized members of an Orthodox Church, the inclusion criteria are adult, overweight and/or obese adults, and a recognizable neurosis, e.g., depression and anxiety.

Table 10.

*Clinical Characteristics of Participants and Data Collection Measures.*

<b>Metrics</b>	<b>Baseline</b>	<b>35 Days</b>
Age (years)	<input checked="" type="checkbox"/>	
Weight (kg)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
BMI (kg/m <sup>2</sup> )	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Systolic blood pressure (mmHg)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Diastolic blood pressure (mmHg)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Metabolic markers		
Total cholesterol (mg/dL)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
HDL-cholesterol (mg/dL)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
LDL-cholesterol (mg/dL)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Triglycerides (mg/dL)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Triglyceride-HDL ratio	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Fasting glucose	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Insulin: (uIU/ml)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Calcium (mg/dL)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Liver markers		
ALT (IU/l)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
AST (IU/l)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
BUN (mg/dL)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Albumin: (mg/dL)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Urinary organic acid testing (OAT)	<input checked="" type="checkbox"/> *	<input checked="" type="checkbox"/>
Patient-reported questionnaires		
24-Hour dietary recall (weekly)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Quality of Life Depression Scale	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
State-Trait Anxiety Inventory	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Five Facets of Mindfulness	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Meaning in Life Questionnaire	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

ALT, alanine aminotransferase; AST, aspartate aminotransferase; BMI, body mass index;

BUN, blood urea nitrogen; HDL, high-density lipoprotein; LDL, low-density lipoprotein

\* if economically feasible within study parameters

The protocol itself will consist of fasting rules as traditionally maintained by the Eastern Orthodox Christian Church and as delineated in Table 1. If conducted during the Lenten period, this will be the format for the entirety of the cycle; however, if examined during the Nativity fast, oil and wine are acceptable on Tuesdays and Thursdays, and oil, wine, and fish are permissible on Weekends. As such, it takes on the observance of a semi-vegan, low-fat diet for three days, semi-vegan diet for two days and a pescatarian diet for two days; therefore, unlike the other times of the year for the Orthodox, which are more analogous to the 5:2 intermittent fasting model, these are much more strict fasts, approximating something of a modified 4:3 format.

However, it is to be noted that while this is the traditional protocol, it is not a legalistic methodology, and alternatives catered to individual health needs can be enacted and explored further in separate investigations utilizing this framework. Regardless, the participants are to be advised to eat as modestly as is possible, and according to their energetic needs, i.e., based on their physical level.

Having established that, the other aspects, i.e., prayer, confession, liturgical attendance, and almsgiving, are equally as crucial for the intervention. As demonstrated throughout the paper, the potential of hesychastic prayer in the improvement of health through all three dimensions is excellent. Confession, as administered within the Church, is for the individual development of *metanoia*, which, unlike secular psychotherapy that focuses exclusively on the mind, encompasses the noetic dimension, as well. Liturgical attendance is designed to help the individual experience the transcendent, and as demonstrated earlier, church attendance is associated with the establishment of *telos* and reductions in morbidity and mortality. Almsgiving additionally provides the individual

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with a sense of purpose and, in the case of active volunteering, encourages higher levels of physical activity.

The markers and questionnaires outlined are designed to encompass a broad spectrum of measurements through multiple health dimensions: (1) anthropometric data for weight-related outcomes; (2) blood lipid measures for inflammatory, cardiovascular, and metabolic syndrome risk factors; (3) liver markers for inflammation and monitoring for adverse effects from potential insufficient dietary protein intake; (4) urinary organic acids for determinations on nutritional, oxidative stress, and mitochondrial status, as well as neurotransmitter metabolites; and (5) general subjective self-reported measurements of quality of life, as well as helping to ensure protocol compliance. Synthesizing this information, this initial exploratory case series will help to validate the theoretical efficacy of the protocol advocated for in this thesis.

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APPENDICES

**Appendix A**

**Definition of Orthodox Christian Terms**

***Acedia***: Literally “negligence” or a “lack of care,” it is a *pathoi* characterized by a depressive syndrome with “listlessness” or “slothfulness,” closely associated with modern conceptions of major depression (Larchet, 2005; Vujisic, 2009; Bradford, 2011).

***Ascesis***: Literally “exercise” or “training,” it refers to the physical, psychological and spiritual method of struggle towards the “purification of the heart,” illumination of the *nous*, and subsequent *theosis* (Vujisic, 2009; Ilievski, 2015).

***Egkrateia***: Literally “mastery,” it is often translated as “temperance” or “self-control.” It is the engagement of the will of the individual in the avoidance of the *logismoi*, *pathoi* and *hamartia* (Larchet, 2017).

***Gastrimargia***: Literally “gut madness,” it is a *pathoi* characterized by overindulgence, more specifically overeating, as commonly understood as gluttony (Larchet, 2017).

***Hamartia***: Often translated as “sin,” it is better understood as a condition whereby an individual has “missed the mark,” through either voluntary or involuntary activity; thus rather than being a legal term, it describes a state of illness, due to movement away from the uncreated energies (Vujisic, 2009; Vlachos, 2010).

***Hesychasm***: The practice of *hesychia*, or “stillness,” in prayer, as articulated through the tradition of Orthodox Christianity. Exoterically, it is characterized by specific bodily postures, breathing patterns, and repetitions of the Jesus Prayer. However, the goal is the quieting of the passions towards the development and

illumination of the *nous*, through the contemplation of the *logoi* and *Logos* (Bakić-Hayden, 2008; Vujisic, 2009; Ware, 2014; Nicolaidis et al., 2016).

**Hesychia:** Literally “stillness” or “silence,” particularly of the thoughts, through the process of illumining the *nous*, it the goal of the practice of the “Jesus Prayer” (Vujisic, 2009; Vlachos, 2010; Ilievski, 2015).

**Logismoi:** The collection of sensory stimulations and their associated mental images, thoughts, and rational or tempting suggestions. These phenomena are considered a consequence of the disunity of *nous*, holding it captive to phantasms, and are thus a primary target of ascetic practice (Bakić-Hayden, 2008; Vujisic, 2009; Ilievski, 2015; Martin, 2015).

**Logoi:** Uncreated “principles or thoughts” of and co-existent to the *Logos*, which represent the substructure of reality, contemplated through the refinement of the *nous* (Vujisic, 2009; Bradford, 2011; Martin, 2015).

**Logos:** The second Person of the Godhead in the Orthodox Christian Trinity, i.e., Jesus Christ. As the divine Word of God, the *Logos* represents the superstructure that maintains reality, as manifested in the *logoi*. The relationship between the *Logos* and the *logoi* provides a solution to the dialectic of the one and the many. Moreover, He is representative of the Intellect, Wisdom, and Providence of God, such that all contemplation of the *nous* is directed towards Him (Vujisic, 2009; Martin, 2015).

**Metanoia:** Often translated as “repentance,” it is better understood as a radical shift in the *nous*, i.e., literally a “change of heart/mind,” characterized by humility and “submission” of the heart to the transcendent (Vujisic, 2009; Vlachos, 2010; Ilievski, 2015).

**Nepsis:** Literally “sobriety” or “watchfulness, it is a state of spiritual vigilance and attentiveness, which guards the heart from the assault of the *logismoi* (Vujisic, 2009; Vlachos, 2010).

**Nous:** Often translated as “eye of the heart,” “intellect,” or “mind,” it represents the organ through which man can intuit the uncreated energies. Generally darkened, the goal of ascetic practices is its illumination through *nepsis* and contemplation of the *logoi*. Along with the *psyche* (soul/mind) and *soma* (body), it represents the third aspect of the tripartite human person (Bakić-Hayden, 2008; Vujisic, 2009; Ilievski, 2015; Martin, 2015).

**Pathoi:** Literally “passions,” they represent the progression of the *logismoi* into states of illness of the *nous*, through the continual engagement of *hamartia*. These are most commonly delineated as *philautia*, pride, vanity, *acedia*, *gastrimargia*, sexual passions, avarice, and anger. (Vujisic, 2009; Ilievski, 2015; Martin, 2015).

**Philautia:** Literally “self-love,” it is a *pathoi* characterized by a narcissistic over-appreciation for the self. In contrast to modern psychological recommendations to embrace self-love, it is regarded as a pathological condition to be combatted through *nepsis* and *hesychia* (Larchet, 2017; Johnson et al., 2018).

**Psychē:** Literally “soul,” it is the life-principle, but also has the modern connotation of the unconscious and conscious mind, from which psychology derives its name. Similar to the human person, it is also tripartite, consisting of vegetative, animal, and rational dimensions, with the *nous* representing the highest aspect of the soul (Vujisic, 2009; Ilievski, 2015).

***Telos:*** Literally “purpose” or “goal,” it is the life meaning that individuals long to possess, specifically, the achievement of *theosis* (Larchet, 2005; Hamalis, 2013).

***Theosis:*** The process of engagement in the uncreated energies and subsequent divinization through the synergistic action between man and God. Also known as deification, it is the goal of ascetic practices in the illumination of the *nous* (Meyendorff, 1998; Vujisic, 2009; Ilievski, 2015).



## **Appendix B**

### **Abbreviations**

6MWT: 6 Minute Walking Test  
8-OhdG: 8-hydroxy-2'-deoxyguanosine  
ACS: Affective Control Scale  
ADF: alternate day fasting  
ALT: alanine aminotransferase  
AM: Athonian monks  
ARI: acute respiratory illness  
AST: aspartate aminotransferase  
ADHD: attention-deficit hyperactivity disorder  
APTT: activated partial thromboplastin time  
BAI: Beck Anxiety Inventory  
BDI: Beck Depression Inventory  
BDNF: brain-derived neurotrophic factor  
BEM: brain-education meditation  
BF: body fat  
BM: body mass  
BMI: body mass index  
BP: blood pressure  
BUN: blood urea nitrogen  
CAMS-R: Cognitive and Affective Mindfulness Scale-Revised  
CAPS: Clinician-Administered PTSD Scale  
CARS: Concerns About Recurrence Scale  
CAVLT: Chinese Auditory Verbal Learning Scale  
CBT: cognitive behavioral therapy  
CDC: Centers for Disease Control and Prevention  
CER: continuous energy restriction

## FASTING & PRAYER FOR MDOC

CES-D: Center for Epidemiologic Studies-Depression Scale

CI: confidence interval

COPD: Chronic obstructive pulmonary disease

CPE: cognitive psychological education

CR: caloric restriction

CRM: consciously resting meditation

CRP: c-reactive protein

C-SOSI: Calgary Symptoms of Stress Inventory

$\Delta$ : change

DASH: Dietary Approaches to Stop Hypertension

DASS<sub>21</sub>: Depression Anxiety Stress Scale

DDC: DOPA decarboxylase

DEBQ: Dutch Eating Behavior Questionnaire

DER: daily energy restriction

DERS: Difficulties in Emotion Regulation Scale

DES: Differential Emotion Scale

DHA: docosahexaenoic acid

DRI: Dietary Reference Intake

DSE: Daily Spiritual Experience Scale

dTRF: delayed time-restricted feeding

eTRF: early time-restricted feeding

EER: estimated energy requirements

ER-15: Resilience Scale

EQ-VAS: Euro Quality of Life-visual analog scale

FACIT, sp: Functional Assessment of Chronic Illness Therapy–Spiritual Wellness  
Scale

FCR: fasting and calorie restriction

FFMQ: Five Facets Mindfulness Questionnaire

FSI: Fatigue Symptom Inventory

FSS: Fatigue Severity Scale  
GAD7: Generalized Anxiety Disorder Questionnaire-7  
GF: general population fasters  
GHQ-28: General Health Questionnaire  
GRID-HAMD: GRID-Hamilton Rating Scale for Depression  
GSE, General Self-Efficacy scale  
HADS: Hospital Anxiety and Depression Scale  
HbA<sub>1c</sub>: hemoglobin A1c  
HDL: high-density lipoprotein  
HDRS: Hamilton Depression Rating Scale  
HMB:  $\beta$ -hydroxy  $\beta$ -methylbutyrate  
HPA axis: hypothalamic-pituitary-adrenal axis  
IBS-QOL: Irritable Bowel Syndrome Quality of Life  
IBS-SSS: Irritable Bowel Syndrome Severity Scoring System  
IECR: intermittent energy and carbohydrate restriction  
IECR + PF: intermittent energy and carbohydrate restriction + *ad libitum* protein and fat  
IER: intermittent energy restriction  
IER-MED: Mediterranean-style intermittent energy restriction diet  
IF: intermittent fasting  
ImmRA: immediate recall after interference  
IS: insulin sensitivity  
ISI: Insomnia Severity Index  
IUS: Intolerance of Uncertainty Scale  
KIMS: Kentucky Inventory of Mindfulness Skills  
LDL: low-density lipoprotein  
MBCT: mindfulness-based cognitive therapy  
MBRS: mindfulness-based stress reduction  
MH5: Mental Health Scale

## FASTING & PRAYER FOR MDOC

MOS SLP9: Medical Outcome Study Sleep Scale

NAD<sup>+</sup>: nicotinamide adenine dinucleotide +

NRD: non-restrictive day

PANAS: Positive and Negative Affect Scale

PCL-M: PTSD Checklist – Military

PHQ-9: Patient Health Questionnaire

POMS: Profile of Mood Scale

PSS: Perceived Stress Scale

PSWQ, Penn State Worry Questionnaire

PTSD: post-traumatic stress disorder

QIDS: Quick Inventory of Depressive Symptomology

QOLIE-31-P: Patient-Weighted Quality of Life in Epilepsy Inventory

RD: restrictive day

RMR: resting metabolic rate

RPSS, Religious Problem-Solving Scale

RRD: Rumination Response Scale

R/S: religiosity/spirituality

SAES: Spielberger Anger Expression Scale

SAI: Spielberger State Anxiety Inventory

SCL-90-R: Revised Symptom Checklist 90

SCS: Self-compassion Scale

SERD: standard energy-restricted diet

SF-12: 12-Item Short-Form Health Survey

SF-36: 36-Item Short-Form Health Survey

SpO<sub>2</sub>: peripheral capillary oxygen saturation

SPRQ-C: St. George Respiratory Questionnaire – COPD

SS: Surrender Scale

STAI: State-Trait Anxiety Inventory

STAXI-2, Spielberger's State-Trait Anger Expression Inventory

## FASTING & PRAYER FOR MDOC

SWLS: Satisfaction with Life Scale

T2DM: type 2 diabetes mellitus

TAC: total antioxidant capacity

TAU: treatment as usual

TBARS: thiobarbituric acid reactive substances

TCS: Treatment Credibility Scale

TM: transcendental meditation

TEE: total energy expenditure

TNF- $\alpha$ : tumor necrosis factor-alpha

TPH2: tryptophan hydroxylase 2

TRF: time-restricted feeding

VAS: visual analog scale

VAT: visceral adipose tissue

VLDL: very-low-density lipoprotein

WHO-QOL: World Health Organization Quality of Life Scale

WOWO: week-on-week-off